

# Popular Wireless

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No. 358. Vol. XV.

INCORPORATING "WIRELESS"

April 13th, 1929.

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*Full  
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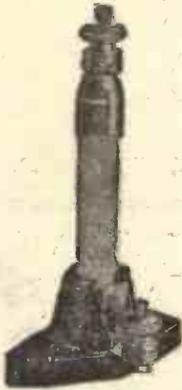


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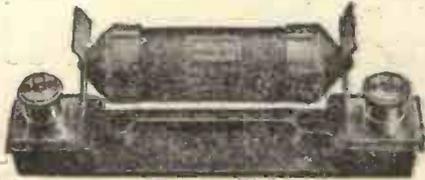


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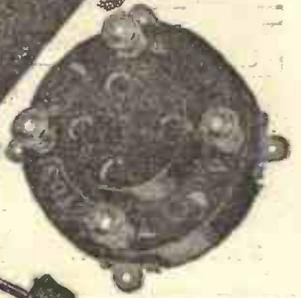
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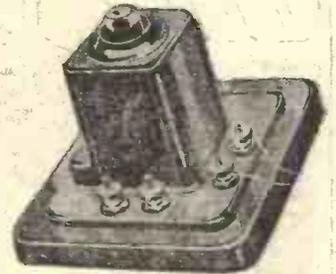


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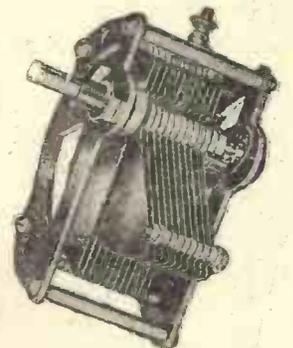
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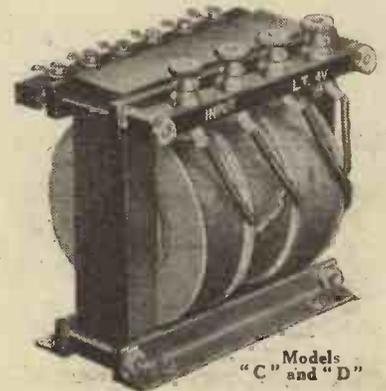
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Models "C" and "D"

Among the wide range of rigorously tested Marconiphone Transformers there are models to suit the needs of every constructor.

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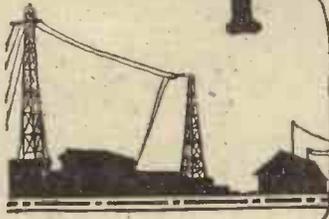


# Cossor

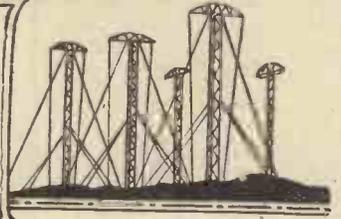
BRITAIN'S FINEST VALVES



# Popular Wireless



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## RADIO NOTES AND NEWS.

From Noise to Noise—The Liverpool Station—Next, Please!—Wireless Heating—Ferranti's Good Deed—History of a "Fan"—"Fig-yers."

### Yet Another Farewell.

AS I write I hear the little bird whisper that the B.B.C. has said a tearless good-bye to yet another popular band, that of the Hotel Cecil. Most probably the murder will be out before you see these lines. No doubt this process of elimination is all for our good, but you don't notice any of the more dry-as-dust features of the programmes getting axed.

### From Noise to Noise.

THE atmosphere of "talks" has so influenced Mr. R. E. Jeffrey that he has joined British International Pictures, Ltd., in charge of the Sound Production Dept. I am sure his productions will be as sound as a bell. Having had our little joke we wish Mr. Jeffrey the best of luck. During his sojourn with the B.B.C. he did well for the public and for the art of broadcasting.

### More "Proms" This Year.

I AM glad to say that the B.B.C. has decided to hold an eight weeks' season of Promenade Concerts this year. Sir Henry Wood will conduct and they will begin on August 17th and end on October 12th. Queen's Hall, I presume. If you want a change, why not drop in on a few of these "Proms"? Jolly crowd and generally real music. There is a something there which cannot be felt and heard via the B.B.C. Try it!

### Flying and Radio Grow Together.

A FRENCH concern, the Aerial Navigation Company, which is shortly to open a transport line between Marseilles and Beyrouth, has decided to set up a wireless system to co-operate in the service. Primarily there will be four stations built—at Athens, Corfu, Beyrouth and Bastia. Transmission will be on long and short waves, telegraphy and telephony. Plans for a wireless system for the British air service to India are already being executed.

### The Liverpool Station.

THE B.B.C. announces that the Liverpool Station has now been included among those stations transmitting on the national common wave-length of 288.5 metres (1,040 kilohertz), which is ultimately to be adopted by practically all British

relay stations. As the Liverpool Station at present transmits on a frequency of 1,020 kilohertz (294.1 metres), the change is so slight that very little, if any, readjustment of listeners' receiving apparatus should be necessary.

### Next, Please!

BURIED deep in a Somerset village the cobbler was discovered "listening in." The observant visitor, noticing that between one hairy ear and one ear-piece the old chap had stuffed a wad of newspaper, asked questions.

"Well," said the listener, "this here's me good hear, an' that 'un's me bad 'un. When I has both a' goin' the bad 'un sort of 'ampers the good 'un. So I shuts 'im off."

Reminds one of the tailor who went out in a boat to the rescue of a bather, using one oar. He said that two hampered him.

### And Here is the Next.

A RED Indian was given a radio set, and the donor sat by during the try-out, to observe the effect. First a lady sang, "Summer is a comin' in." No remarks from the red man. Then a man sang a song about harvest. Not a muscle of the red face moved. Next, a lady sang about spring. No movement. Then a man sang, "Blow, blow, thou winter wind." The Indian gravely handed over the 'phones. "This thing lies like a trader," he said. "Give me some rum and blankets instead."

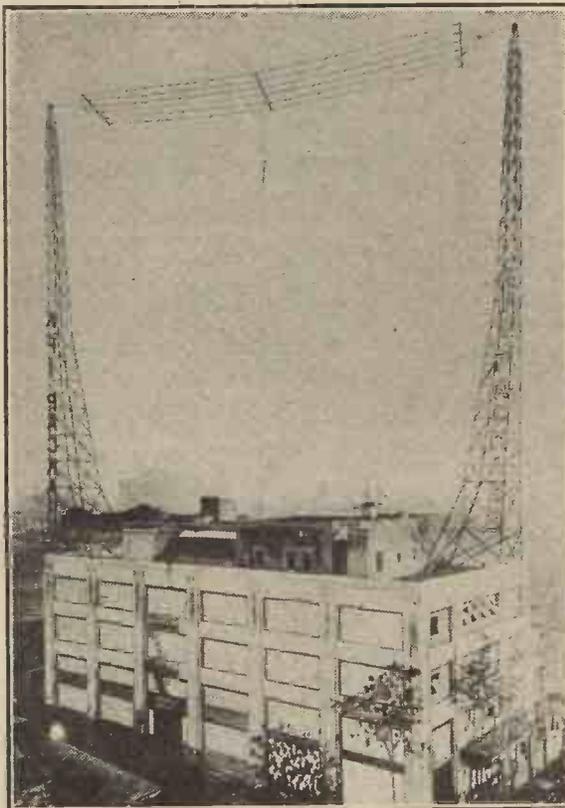
### Those Small Beginnings.

THE Grand Duchy of Luxemburg has saved up its pennies and bought a nice ickle radio station, "Radio-Luxemburg." So powerful is it that it can be heard all over the State—and almost over the other side of the wall. The State has an area of 998 square miles, by the way. This is the spirit I like to see. "Small but proud." "Luxemburg will be there." etc. I hear that Monaco is making a capital levy for the purchase of a drum—for broadcasting; and that Andorra (175 square miles) is experimenting with hollowed tree trunks.

### Find the Parent.

MUCH as I admire the gifts of imagination and prophecy with which Mr. David Sarnoff is endowed, I cannot agree (Continued on next page.)

## AN AMERICAN SUPER-STATION.



This view of the Los Angeles broadcasting station, KFI, shows how the giant aerial masts are erected on a tall building. Although 8,000 miles from England, its programmes have been picked up in this country.

## NOTES AND NEWS.

(Continued from previous page.)

with his claim to be the father of broadcasting because he suggested it in a memorandum written in 1914. Surely our own national "Punch" earned the honour way back in the Middle Victorian era, when it published a picture of a contraption with dials on it, and of a lady telling the butler to be sure to turn on the grand opera at nine o'clock.

### India Steps Back.

MELANCHOLY is the news that the Indian Broadcasting Company has turned to the broadcasting of advertisements in order to swell its revenues; firstly, because, I think, the step is retrograde, and secondly, because it argues that something is unwell in the state of Indian broadcasting—symptoms we have already noticed, at the time of *Puffaire Dunstan*. Undoubtedly this is a case for help from the Government of India, as I have before urged.

### Wireless Heating.

ON DIT—I have been reading the "Woman's page" of my newspaper, and picked up that saucy bit—*on dit* in Paris that Mr. J. Risler has discovered wirelessly-operated heating plants in Germany. Powerful waves of from two to three metres long are caused to excite filaments in vacua, thus creating electric radiators. I don't feel much impressed with the French gentleman's visions for a radio-heated Paris, though he may succeed in toasting a bit of cheese by wireless—radio rarebits, eh?

### Ferranti's Good Deed.

IN our issue of March 9th, page 1343, we published a photograph of a pavement artist drawing a picture of a trickle-charger. The story behind this is a nice one. Ferranti's engaged him for a day, and he succeeded in "drawing" a crowd so big that the police stopped him. He was engaged again at the time of the Olympia Radio show, and again the police chipped in. However, he raked in enough during the three days of Ferrantism to pay his debts. He is now in a job—and has got married.

### Wireless and Weather.

THE Symons Memorial Lecture of the Royal Meteorological Society was delivered on March 20th, and dealt with wireless and weather. Many interesting facts were given, amongst which was that the results of weather observations made all over the northern hemisphere are received by the central forecaster within six hours, thanks to radio. It was stated that in a tropical night "atmospherics" may arrive at the rate of 3,000 to 4,000 per second; that the average atmospheric is 100,000 times as strong as a readable signal, and that the average one received in England is of such strength as would be sent out by a storm 2,000 miles away.

### Fultograph and Weather.

THE preceding note reminds me of the increasing popularity of the Fultograph system of picture transmission. In addition to the broadcasting of pictures for entertainment purposes there is a large

and useful field for this method in the distribution of weather maps and meteorological data—a field which the R.A.F. is already exploring. I hear that a film called "The Fultograph Story," incorporated in the well-known Pathé Pictorial, has had a large booking.

### History of a "Fan."

YOU who have climbed up from your marvellous first crystal or one-valver, through numberless experiments, till you reached the set by which you now swear, may occasionally like to read the radio life history of a fellow-fan. Here's one, that of W. G. (W. Norwood).

## SHORT WAVES.

We understand that women are not using the transatlantic telephones to any great extent. Judging by the time we waited outside a certain telephone call-box the other day, we can quite believe this.

### AT THE STUDIO DOOR.

Studio Manager: "What's the matter? You look all in."

Bedtime Story-teller: "I had to hurry down without anything to eat. I slept in to-day."

Studio Manager: "Well, make it snappy, and get on the air with your bedtime story."—"Radio News."

A woman in a provincial police-court recently declared that the wireless waves came through her gas-pipes, burnt her hair, and threw her out of bed.

A correspondent writes to congratulate us on a two-valve circuit recently published in "P.W.". He says that the other evening he got so many stations on it, one after another, that the grid leak got red-hot. Although he signed his letter "G. W.," we hardly think this stands for "George Washington."

### SHADOWED TO HIS DOOM.

Fan No. 1: "Say, why are you so interested in getting a television set working?"

Fan No. 2: "I want to see what Old Man Statte looks like, so I'll know him. They'll get him, and get him good, too!"—"Radio News."

### WIRELESS AND THE SALES.

12.0 News Bulletin.—Special list of latest market prices from the Frock Exchange.

12.30.—Language Series. The Meaning, Derivation and Pronunciation of Technical Terms. First talk will deal with Modom, Tré; Chic, Bargain, Recherche and Startling.—"Daily News."

### ANOTHER VERSION.

Harry: "MacTavish never tries to get anything but locals on his set. I wonder why?"

Patrick: "Whisht! Don't you know he thinks there's an extra charge for long distance?"

He began with the "Hale," all Hale and (Hamilton) Harty. Then came "Signal Box," "Concert" Four, "Radiano" Three, and "P.W." Four. An interval of several other sets, vintage not stated, and then came "the roof and crown of things," the "Solodyne" Three, first, second, and third versions, the last being the best. See White Prints.

### Private and Personal.

FRIEND READER, of your charity pray spare me this inch of your space in which to acknowledge letters from J. A. K. (Witney), J. L. (Mansfield), H. K. (Hereford), E. W. G. T. (Ware), and A. G. M. (Stoke-on-Trent). All very interesting. Trouble in writing, and good wishes for "P.W." and self hugely appreciated, but no meat of outstanding general interest in them, hence this omnibus note. Carry on!

### Long-Distance Fans Wanted.

THE directors of that enterprising 7 L O (Nairobi), which works on 400 metres and 31 metres, would be very glad to have reports on the reception of that station in Great Britain. The best times to listen here for 7 L O are from 4.0 p.m. to 7.0 p.m. (G.M.T.) on week-days, and from 7.0 p.m. to 8.0 p.m. (G.M.T.) on Sundays. I presume that the reports should give date and time, strength (L.S. or 'phones) and some data about the set, number of valves, etc., besides notes on fading and so forth.

### The Pot and the Kettle.

THE other day, while I and a few select radiomaniacs were babbling of screened-grid valves, an outsider remarked that we were not talking English. He was very superior, not unpleasantly, and said that being a fisherman he preferred the English of Izaak Walton. It so happened that last night I struck acquaintance with two anglers who were discussing Easter plans, and their jargon! One was going "Gundling for snerb." The other was going "Sliking for carp." And someone else was going "Cratchelling for bream." That is as nearly as I can recollect the words. Pot and kettle!

### "Fig-yers."

OR, as we should say if the B.B.C. had not corrupted our speech—figgers. A 15 cents publication called "Radio Markets of the World" tells me that there are 20 million radio sets in use, of which nearly 10 million are in the U.S.A. Great Britain and Germany come next, with two and a half million sets apiece. Further, it is stated that over 95 per cent of all the sets in the North American continent (never heard of it!) are in the U.S.A. As the rest of N. America consists mostly of Canada it isn't much to boast about. In South America the Argentine contains more than half the sets in use.

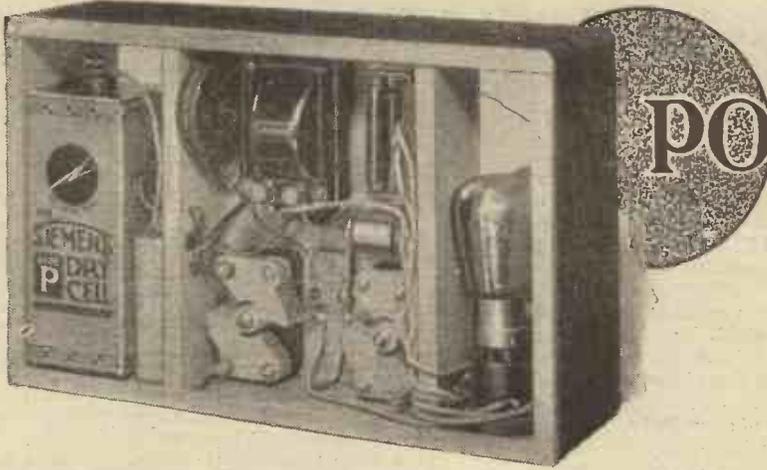
### Pillion-Rider à la Mode.

STROLLING out at Easter I found that there was little to see besides a stream of cars and motor-cycles, varied occasionally by the happy family crowded into a delivery van. Naturally, I kept a sharp look-out for portables or radio-equipped cars, but drew a blank during two hours. Just as I turned to leave the main road I was amply rewarded by the sight of a motor-bike which had a portable on the pillion; on each side of the portable hung a beautiful silk stocking, stuffed to represent the real article. I took the number, but I won't divulge it.

### We Salute . . .

HIS MAJESTY THE KING, for having his wireless set sent down to Bognor as soon as ever they would let him. Mr. Ernest R. Gilbert, well-known advertising agent, for producing a sand-glass ("egg-boiler") just before he made a speech at S. G. Brown's Annual Banquet. Senatore Marconi, for arranging to put a wireless station in the Vatican for the Pope. Mr. Eric Dunstan, for celebrating his return from India by becoming engaged to be married. And the chief of the B.B.C. control room, for so "controlling" a specially awful symphony recently that it was mostly inaudible.

ARIEL



# MAKING PORTABLE SETS

The author has very definite views on the subject, and these are based on years of practical experimenting with sets of this type. In this article he deals both with circuits and the actual assembly of sets for summer use.

By J. ENGLISH.

AS many of you, about this time, will be thinking of making up a portable receiver, I am going to deal with the chief points in the design and construction of this fascinating type of receiver, trusting that it will be of assistance in making the set you have in mind.

First of all, let us be clear in our minds as to what constitutes a portable receiver. I consider any outfit with a built-in loud speaker and frame aerial definitely in the "transportable" class.

having to open the case, thanks to the built-in frame aerial, on which good 'phone reception is possible up to 30 miles or so from the local station.

Provision would be made for an outside aerial for long-distance reception on both medium and long wavelengths. No more than two valves would be used with a maximum H.T. supply of 60 volts, so that the set would be quite efficient, versatile, and economical.

Now I do not expect that all of you will agree with my ideas of what a portable set should be. I know that some people would scorn to build anything less than a three-valve portable.

### Choice of Circuit.

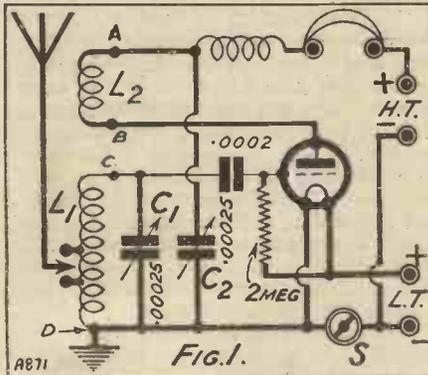
This kind of set is, in my opinion, really on the border-line between the portable and the transportable; a cunning constructor can make it very nearly a portable, even allowing for a built-in loud speaker, but generally the result of your efforts will be a set very much of the transportable type.

The problems you will come up against in designing and constructing portable receivers are not nearly so complex and troublesome as those encountered with transportables. These, I can well imagine, have given designers more sleepless nights than any other type of receiver!

However, even with the simplest of portables for 'phone reception it is not merely a matter of cramming the necessary parts into a small suit-case, packing in the batteries and then hoping for the best!

To get the maximum of interest and enjoyment from your set you must first consider such things as a suitable circuit for easy control and sensitivity with a simple layout, and the best way of construction for getting the components and batteries into a small handy case.

Before we go any further, I would advise the constructor who has not a previous

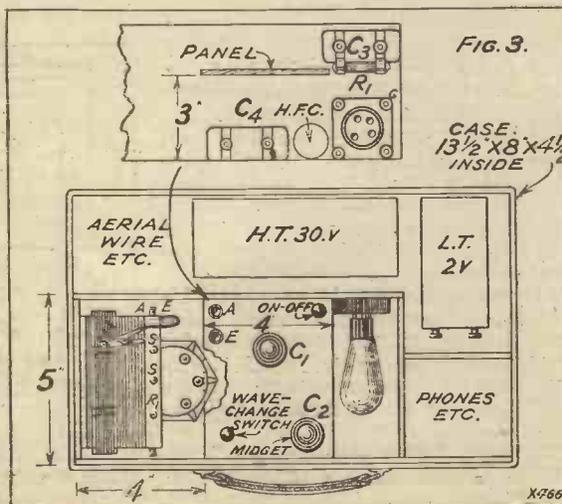
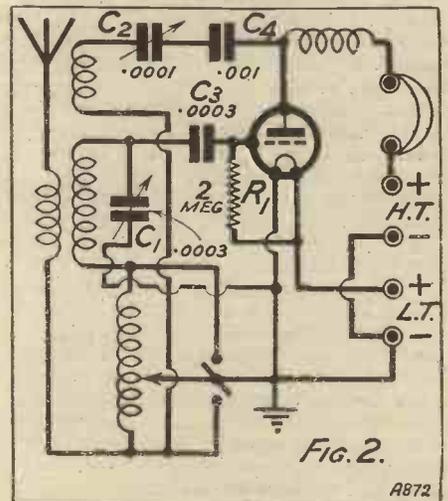


It is well nigh impossible to construct such a set up to modern standards of quality, volume and range without increasing its weight beyond the limits of true portability. My idea of a portable is an outfit weighing not more than twelve pounds in all, built into a case no bigger than 15 in. by 10 in. by 5 in. From past experience I can say that this is just about the right weight and size for comfortable carrying, wherever you may go.

### No Knobs!

Of course, we cannot make a loud-speaker set of it, but I expect many of you want a handy little 'phone receiver for general use this summer, without parting with the cash necessary for a transportable.

Now let me give you an impression of what I consider to be the ideal portable of the weight and size already mentioned. Outwardly no obtrusive control knobs spoil its appearance, which should not suggest a wireless set at all. It is easily operated without



experience of portables to leave the loud-speaker transportable alone, until he has made up at least a two-valve portable. The experience then gained will enable him to tackle the bigger outfit with more confidence and a greater chance of success.

### One- and Two-Valvers.

If you are in doubt as to what type of portable to make up—and this is often a problem—a consideration of the following points will doubtless help you to decide what receiver will best suit both your requirements and your pocket.

The one-valve portable is essentially a set for use with a temporary aerial system. It is a very useful sort of set for outdoor use, inexpensive, and quite instructive for the beginner. The average cost of this type of set is about twenty-five shillings, excluding valve and batteries, so that it is quite an attractive proposition for anyone who does not wish to lay out a lot of money, or tie up useful components in a portable.

With the two-valve portable there is more chance of using successfully a built-in frame aerial, when the set can be operated with the

(Continued on next page.)

# MAKING PORTABLE SETS.

(Continued from previous page.)

case closed up, whether walking or traveling by car or train, and where it is impossible to erect even a small temporary aerial.

Such a set is the last word in versatile reception, having a good 'phone range on the frame alone, while its weight is very little more than that of a one-valve outfit. The average cost of a good two-valve portable is about forty-five shillings, excluding valves and batteries, so that you get good value for your money.

### Regulating Reaction.

With three valves we can be sure of loud-speaker reception from at least the local station, but on the built-in frame it will not be sufficiently powerful to bring in other stations unless special circuits are used. In any case it is a hybrid sort of receiver, and in view of the difficulties of getting it down to portable dimensions, it is well worth while adding an extra valve, making it definitely a trans-portable.

We will now run through some of the chief things to be considered in making up the one-and two-valve portables. Even if the one-valver is unpretentious, it can be made a very versatile outfit and, as there are no real problems of design and construction, the keen amateur can often get more enjoyment out of it than the owner of a multi-valve trans-portable.

When choosing a circuit for a one-valver, remember that generally the simpler the circuit the more successful will it be in operation, and that with only one valve at our disposal we are absolutely dependent upon reaction for good signals. The circuit you use must therefore be capable of giving a very smooth and easy control of reaction.

In Fig. 1 we have an efficient and simple circuit very suitable for a one-valve portable as it requires so few components. The circuit works well with most H.F. and general-purpose valves, the system of throttle control employed giving a particularly smooth adjustment of reaction. Two or three tapping points on the grid coil for

If you favour wave-change schemes, beware of complicated switching. By fitting four terminals or sockets at the points marked A, B, C and D in Fig. 1, you can easily change over coils, space being found in the case for the one not in use.

### The "Titan" Coil.

For a small additional outlay, the careful constructor can work into his set one of the new combined-wave coil units designed for the "Titan" Three. This makes a very compact and sensitive set for both wave-length ranges, putting up a good performance on quite a modest aerial system such as you can contrive by attaching one end of a length of insulated wire to a tree, with one or two short brass rods driven into the ground for an earth connection.

As this type of set will, I am sure, appeal to many constructors who require an efficient and compact one-valver of a universal type, I have sketched in Fig. 3 a suggested layout for the outfit, the theoretical circuit being shown in Fig. 2. However, there is no need to follow blindly this method of construction, as there are

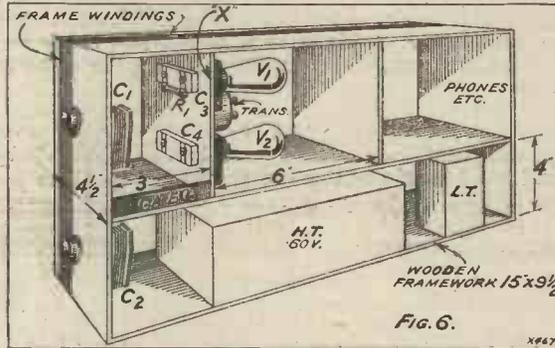


FIG. 6.

several other successful ways of making-up such a set.

In fact, building a portable is much more fun than constructing an ordinary stay-at-home receiver, as there is infinitely more scope for working in original ideas of your own. Do not, however, depart from the idea of a skeleton framework of thin 1/4-in. wood to which are secured the various components, this framework serving also to divide off compartments for the batteries, 'phones, etc.

There is no need to use ebonite bushings for condensers and terminals secured to the framework, as its insulation is quite good enough if you use well-seasoned and dry wood.

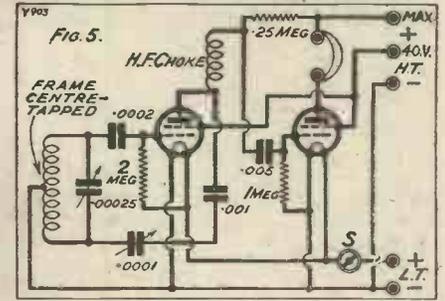
### Suit-case Sizes.

There are several other useful circuits for your one-valve portable, but considerations of space will not allow me to deal with them now. I would not advise you to attempt to use a built-in frame aerial. The carrying case will be too small to accommodate an efficient frame, and the one-valve detector accordingly gives but mediocre results, except within a range of two or three miles from the local station.

When setting about making your portable it is useful to know that most one-valve sets can be built into a fibre suit-case measuring outside 14 in. by 9 in. by 5 in. over all. Lightweight fibre suit-cases are so cheap nowadays that it is hardly worth while making your own of wood.

This size will allow room for a small non-spillable accumulator, a 30-volt H.T.

battery (you will not require a higher voltage), a pair of 'phones and such sundries as a reel of aerial wire and an earth spike.



Now, two-valve portables are in general merely detector sets of the type we have already considered plus an L.F. stage. The extra valve and transformer do not add much to the weight of the set, and the amount of extra space required is so small that very often a two-valver can be built into the same size case as a one-valver.

Of course, the filament supply needs to be more capacious in order to stand the heavier current drain. When 2-volt valves of the .1 amp. class are used, I personally am in favour of wiring their filaments in series, with a small rheostat also in series.

They can then be run off a small 4 1/2-volt dry battery (even a flash-lamp battery will do at a pinch), as the total current taken from the battery is only 1 amp.

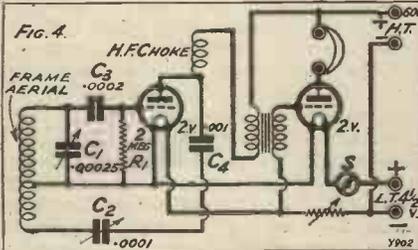
### The L.T. Battery.

My experience has been that although dry batteries have the disadvantage of a falling voltage, they are more satisfactory for small portables than unspillable accumulators. For transportables, however, the position is reversed because such a set is bound to be used more frequently than a portable, and the heavier filament current forces us to use an accumulator, and not a very small one at that.

Coming back to the subject of the two-valve receiver, this is quite a type on its own, and, as I have said before, it is the ideal portable for 'phone reception, being so handy and versatile. Of the many portables I have constructed in the past some of the most successful and interesting have been of the two-valve frame-aerial type.

If you have not yet tried out one of these little sets you will be surprised at the good range of reception. With the proper circuit arrangements you can be sure of strong readable 'phone signals up to at least

(Continued on page 170.)



the aerial coupling provide as much selectivity as you require in a portable.

Both coils L<sub>1</sub> and L<sub>2</sub> can be wound on the same former with fine wire to economise space, the right size of L<sub>2</sub> being found by experiment as the number of turns depends upon the maximum capacity of the throttle condenser C<sub>2</sub>, and other factors.

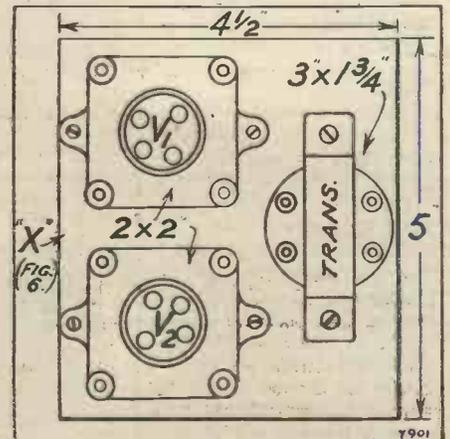


FIG. 6.

HAS it ever occurred to you that some of your difficulties in getting rid of hum from your D.C. mains H.T. unit may be due to the H.F. currents? Probably it hasn't, for it certainly seems a far-fetched idea.

All the same, cases are by no means rare in which actual H.F. currents coming in from the mains make it almost impossible to get rid of hum by ordinary methods.

The difficulty is, you see, that H.F. currents can often make their way quite easily through the ordinary smoothing circuits, for the self-capacity of L.F. chokes is generally high enough to pass them on.

Once through into your set they can kick up no end of noise and give you the idea that you have not provided enough smoothing. As a result, people spend hard-earned cash on more chokes and condensers, only to find little relief. If they knew what the real cause of the trouble was they would be able to remove it in a very simple and inexpensive way which I will describe presently.

Our Own Experience.

The reason why it occurs to me that a short article on this rather curious point may be helpful is an interesting one: the principal electric supply in the "P.W." Research Department is a D.C. one which we have always found particularly difficult to smooth, and until recently we did not know that the trouble was really due to wandering H.F. currents all the time. If we could be deceived in this way I expect it is possible that a good many readers can be similarly misled.

In the past we have always found that the simpler types of D.C. H.T. units gave a good deal of hum here, and we have had to test such designs elsewhere to make sure that they were good enough for normal cases.

For a time we simply assumed that our mains were extremely bad and noisy ones. Yes, we DID put it a little more strongly than that, but you can't expect me to tell you exactly how—and assumed that better smoothing was needed.

As time went on, however, we came across examples of more elaborate H.T. units which gave as much hum here as the simpler ones, whereas if smoothing was all that was needed they should have given a perfectly silent output.

This did not always happen, and we realised that something peculiar was occurring, and started to investigate, for it was obviously not a straightforward business of adequate smoothing, after all.

When making a set be sure to keep the bench clear of odd bits of wire, etc., or otherwise a damaged or scratched panel may easily result.

Metal dust is one of the greatest foes of good reception, so be sure to keep the set free from this if possible when soldering terminals, etc.

If flux is splashed about when a set is being made it not only looks bad but it is a source of loss, due to imperfect insulation.

Always remember to wipe a soldered joint with a clean cloth whilst the metal is still hot.

# H.F. FROM THE MAINS



circuit arrangements of the various H.T. units, which were without significance from the L.F. point of view, but made a lot of difference so far as H.F. currents were concerned.

With the cause once located the remedy was obvious, and when this has been applied we find our mains become quite easy to smooth. This obvious remedy, as the reader will probably have

guessed, is to be found in the use of an H.F. choke in each mains lead. If one is connected in each of the mains leads to the input terminals of the unit the trouble disappears in practically every case.

This in itself is a pretty complete remedy, but we have found one or two units with which it is also desirable to shunt a large condenser (1 or 2 mfd.) across from positive to negative on the unit side of the H.F. chokes.

We were so pleased with our discovery that we immediately made up a little unit containing these chokes and the condenser, with means of interposing it easily between the mains and a unit, and we now find it very handy indeed when we are doing any mains work.

The unit has proved so useful that probably some details will be useful to those readers who suspect their mains are similarly misbehaving. It can be a very simple little affair, as you will see if you look at the picture heading to this page, where you will see the first experimental model we made—(towards the left).

Easy to Make.

This model was made up on a wooden baseboard, but for regular use it should obviously be boxed in. The box should be about 3 in. by 5 in. by 5 in. deep, the exact dimensions rather depending upon the sizes of the chokes and condenser you are going to use. For small and medium currents two ordinary H.F. chokes will serve perfectly well, but if you draw large currents for super-power valves it will be as well to use chokes specially designed for carrying them without over-heating or causing large voltage drops, namely, the Wearite type.

The condenser must, of course, be of the high voltage type, since it is right across the mains. (Minimum safe rating is 250 volts WORKING.) On this page you will find a wiring diagram for the parts mounted on the panel which forms the lid of the box, and you will see that it is a very simple little unit to make up.

or lead pipe, so if you are troubled in this way make sure that your aerial and earth wires are above suspicion.

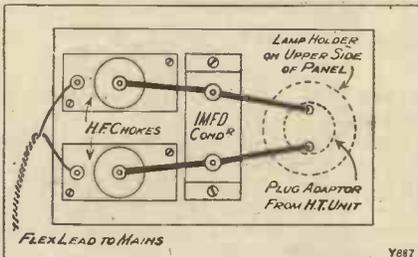
A steady humming noise in a set is very often due to the fact that the aerial or earth wires run too close to the electric-light wiring.

The noises from an old H.T. battery are generally due to imperfect contact inside it, and if you assemble your own batteries do not forget that insulation between rows is more important than insulation between individual cells.

It is probable that quite a number of mains unit enthusiasts are not aware that H.F. can accompany the H.T. from the mains and cause "hum" and distortion. But it is a fact, and in this article a way of eliminating the unwanted effects is described.

By G. P. KENDALL, B.Sc.

The first thing we noticed was that in some cases the removal of the earth lead from the receiving circuit reduced the hum almost to nothing, and this hint soon put us on the track of the explanation of the whole thing.



We found that it was simply that our mains are positively infested with H.F. currents which are not stopped by ordinary smoothing circuits, and may come through and affect the receiver, setting up a hum exactly like that resulting from poor smoothing.

A Simple Unit.

The reason is evidently that these H.F. currents are modulated, so to speak, at the ordinary commutator frequency of the generating dynamo, and so they set up a hum of audible frequency in the set. The fact that the trouble did not always occur was no doubt due to small differences in the

FOR THE HOME CONSTRUCTOR.

Heat softens ebonite so after a terminal which is affixed in a panel has been soldered it will be necessary to tighten the fixing nut a little.

What is called fading is sometimes nothing more than the aerial swinging across a gutter

## LATEST BROADCASTING NEWS.

BAIRD TELEVISION  
AND THE B.B.C.

"THE NINE O'CLOCK REVUE"  
—PROGRAMME BY TOM  
WEBSTER—THE B.B.C. AND  
LORD MELCHETT—CENO-  
TAPH SERVICE—AN EMPIRE  
DAY PROGRAMME—THE  
ROYAL PHILHARMONIC—SIR  
THOMAS BEECHAM—STAFF  
CRISIS AT SAVOY HILL.

IT now seems very likely that Baird Television will become a permanent part of B.B.C. transmission. The Baird people won such a complete political victory that no amount of technical obstruction can prevail, however well-founded. Fortunately, however, there is no disposition to revive any of the bitterness of the previous period of hostilities between Savoy Hill and Long Acre. What will happen will be something like this. The Baird and B.B.C. engineers will begin at once the preliminary experimental and installation work. In July there will be transmissions in London, with one low wave and one of the new regional waves. These experimental transmissions outside programme hours will last for about a year, after which Television will be made a part of the regular programme service along with Fultograph, each adapted to its special use. Now that the B.B.C. has taken up the Baird method, it has received great impetus abroad, and there is something in the nature of a world monopoly being attempted by Lord Amthill, Sir Edward Manville, and their colleagues. Incidentally, it was a curious sight to see Captain Eckersley dining with Mr. Baird in the Savoy the other night. Apparently the hatchet is properly buried. Another moral to be drawn from the incident is that the Post Office, when it likes, does dictate to the B.B.C.

## "The Nine O'Clock Revue."

Morris Harvey, who was part-author and comperé of the original "Nine O'Clock Revue" as produced at the Little Theatre some years ago, will be in charge of the special broadcast version to be given from 5 G B on Thursday, April 18th, and from London on Saturday, April 20th.

## Programme by Tom Webster.

At Savoy Hill there is eager anticipation of the Derby Eve Programme which is to be organised and performed by Tom Webster and some of his sporting friends. It is probable that the programme will take the form of "after-dinner chat." It would be an interesting feature if Tom Webster were to prepare a special cartoon to be Fultographed simultaneously.

## The B.B.C. and Lord Melchett.

A piquant situation was provided by the suggestion that the speeches at a special luncheon of the National Industrial Alliance on April 25th should be broadcast. It was believed in the beginning that Lord Melchett would be among the speakers. In view of the ban against him at Savoy Hill this would have made the broadcasting of

the luncheon impossible. As things turned out, however, Lord Melchett's name was omitted from the final list of speakers. Sir Edward Manville, Mr. J. H. Thomas, and Lord Barnby are the big guns. The broadcast is now arranged.

## Cenotaph Service.

The B.B.C. will broadcast from both 2 L O and 5 G B the special Cenotaph Service being organised by the British Legion on May 19th.

## An Empire Day Programme.

Savoy Hill promises a real Empire Day programme for May 24th. This decision follows a long and acrimonious discussion. For a time it looked as if the "Internationalists" would win with their campaign to eliminate all reference to the British Empire. But in the end the Imperialist faction got its way. What is now being planned is a robust, full-blooded, world-challenging "Rule Britannia" programme for May 24th.

## The Royal Philharmonic.

The Royal Philharmonic Society's Concert, which Sir Henry Wood will conduct at the Queen's Hall on April 18th, will be broadcast by London and 5 X X. Keith

Faulkner will be the soloist. By the way, there is a good chance that in the forthcoming merger of musical organisations in London the "Royal Philharmonic" will confer its name and prestige, as well as a good deal of its talent, on the new B.B.C. Orchestra. In this connection it is believed that H.M.V. and Mr. Lionel Powell will operate a competitive "National" orchestra—good news for artists!

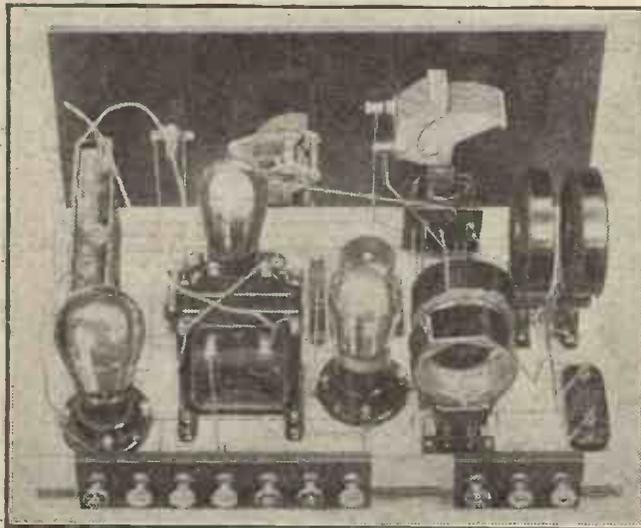
## Sir Thomas Beecham.

There are strong rumours that all is not well between the B.B.C. and Sir Thomas Beecham. Anyway, it is about time the inevitable explosion took place. Sir Thomas makes no secret that he has not changed his mind either about broadcasting or the B.B.C. When the break comes, there will be plenty of fireworks! By the way, what is the truth about the future of music organisation at Savoy Hill?

## Staff Crisis at Savoy Hill.

There is a veritable epidemic of resignations at Savoy Hill. About a dozen pivotal people have left since the beginning of the year, all to better jobs and more money elsewhere. It is understood, for instance, that Mr. R. E. Jeffrey will receive three times his old salary now that he is with talking films. The curious and alarming feature about the whole thing is the utter indifference of the B.B.C. to the loss of some of its best programme builders. The official attitude seems to be one of relief rather than concern. No replacements are being made, so it is presumed that economy is the reason for rejoicing. The demobilisation of the ancillary educational activities was welcomed; but the same reception will not be accorded a policy which will reduce programme work to a repetition of military band concerts.

## THE "TOM-TIT" THREE.



Here is a view of the completed "Tom-Tit" Three (described in this issue), with coils, valves, and the grid-bias battery in position.

## TECHNICAL NOTES.

By Dr. J. H. T. ROBERTS, F.Inst.P.

## PIANO LOUDSPEAKER

ATTACHING THE UNIT—SHORT-WAVE TROUBLES—ETC., ETC.

## Piano Loudspeaker.

SEVERAL readers have written describing various methods of using the wooden case of the pianoforte for the purpose of a loud-speaker radiator; in many cases correspondents report excellent results.

This idea, of course, is not a new one and, in fact, loud-speaker units especially adapted for securing to the pianoforte case have been on the market in various parts of the world, especially in the United States, for some years past, and I understand have met with a considerable sale.

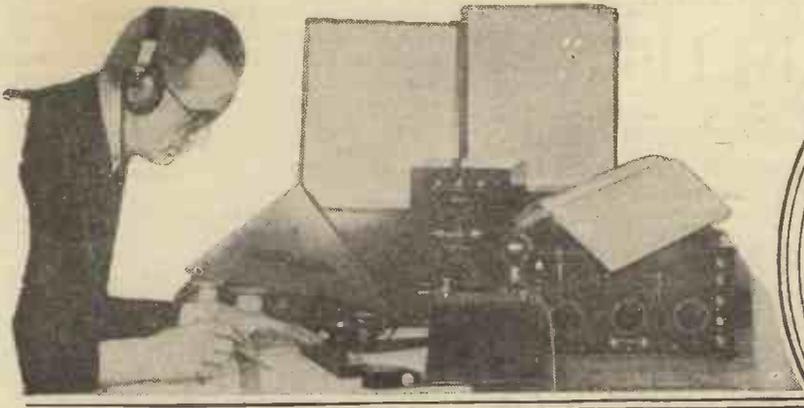
The idea has always seemed to me to be a very good one, for in the pianoforte not only have you a large surface of wood,

which in any case might be expected to act as an efficient radiator, but you have also a complete system of resonators, the like of which you would have to go a very long way to find elsewhere. The complete system of strings of a pianoforte is, indeed, a ready-made and elaborate resonating system and one which represents the result of any amount of research and expenditure.

## Attaching the Unit.

I have made many experiments with loud-speaker units secured to the wood-work of the pianoforte, and have in the majority of cases obtained excellent results.

(Continued on page 154.)

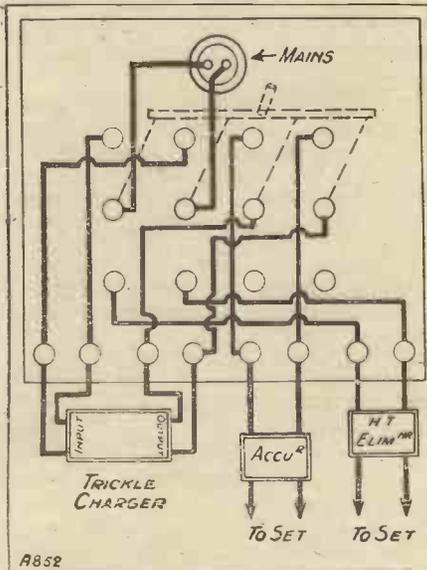


# FOR THE SET BUILDER

### A USEFUL MAINS SWITCH.

**I**N view of the popularity of H.T. units and trickle chargers, here is a useful panel using two double-pole double-throw switches joined together.

It will be seen that the action of putting the switch in the "up" position automatically connects the charger to the mains and the accumulator. Reversing the switch puts the eliminator in the mains circuit and cuts off the charger from both the mains and the accumulator in one operation.



### JAMMING ON 5 X X.

**I**T may be that you are one of those unfortunate listeners who, on attempting to listen to 5 X X or some other long-wave station, find the local station or 5 G B coming in more or less all round the dial. If your set is one in which the aerial is taken to a tap a certain number of turns up the tuned coil, counting from the earth end, there is one scheme which you must try before giving up hope.

The idea is as follows. Instead of employing the auto-coupled aerial arrangement, a separate winding is employed for coupling the aerial to the set. This winding should take the form of either a plug-in coil fixed close up to the grid coil, or a hank winding wound round the tuned coil near to the earth end.

In the case of the plug-in coil, a No. 60, 75, or 100 will do, and in the case of a hank

coil different numbers of turns should be tried.

Although the gauge of wire is unimportant it should be somewhere about No. 30 or No. 32, either D.C.C. or D.S.C. Any number of turns between 60 and 100 can be tried.

The aerial is connected to one end of this fresh coil, and the other end of it is joined to earth or the low potential end of the grid winding. It is difficult to say exactly why the separate coil should not produce the same trouble as the tap, but there is no doubt that in most cases the interference trouble will vanish completely.

### AERIAL DISCONNECTION.

**S**HOULD there be a break or partial break in the aerial circuit of your set, the set will tend to oscillate hard, and signals will, of course, be abnormally weak. Probably the quickest way of determining whether this really has occurred is to detach the aerial lead from the set, and note whether much difference in signal strength results. Signals should, of course, become very much weaker than they were.

### REPAIRING RADIO VALVES.

**R**ADIO valves that have come loose from their bases may be repaired in a few minutes' time with a small quantity of commercial alcohol. At the point where the valve enters the base, pour a few drops of alcohol. Allow the valve to stand for a moment until the alcohol moistens the cement, then press the bulb firmly into its base and set it aside for five or ten minutes.

Upon examination it will be found that the cement has hardened, and the valve is as good as new.

### AERIAL MASTS.

**W**HEN the question crops up as to how far back a mast may be safely erected without taking away too much of the usefulness of the guy wire between the pole and the garden wall or railing, the usual thing is to sacrifice the strength of the erection to an additional foot or so of aerial wire, with the result that the wire sags two or three feet in the middle and the pole makes a bow towards the house. This is obviously not worth while, and in any case you should remember that height in an aerial is more valuable than length.

If the aerial-earth switch is located out-of-doors and allowed to get dirty or sooty, covered with dust, etc., it is quite probable that you are losing a great deal of signal strength in this way.

### BATTERY LEADS.

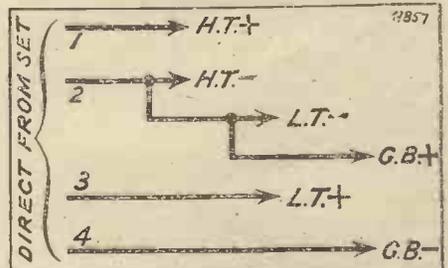
**T**HE idea shown in the sketch is a simple method of arranging battery leads with the object of assuring absolute safety. In addition to this the arrangement is much simpler than the ordinary, and fewer leads can be used, as will be obvious. With most receivers nowadays there is a common connection to H.T. -, L.T. -, and G.B. +; thus, for this purpose one lead equipped with three plugs will suffice. Now if the lengths of the leads are arranged, as shown, each will be out of the way of the other, so that if at the other end they are connected via terminals to the set, there will be no fear of shorts through the bare ends of the leads touching when connecting up or disconnecting.

### A Warning.

A better plan is to connect from the receiver direct, thus making all leads at this end a permanent fixture.

The following rules, however your batteries are connected, are worthy of notice. Always disconnect from the battery end, and not from the set end. Disconnect the H.T. first and then the L.T. Disconnect from the set end only when absolutely necessary, but always disconnect batteries first in any case.

In connecting up, connect all leads at the



set end first, then the accumulator, then the H.T. The observance of these simple rules will save much trouble which undoubtedly does arise on many occasions through carelessness in these directions. Remember the possibilities of confusion with these leads is—first shorting the filament circuit, and secondly shorting the H.T. battery, either form of accident being decidedly harmful.

## THE P.M.G.'s LETTER.

The Postmaster-General recently sent the following letter to the Secretary of the Baird Television Development Company, Limited.

SIR,—The Postmaster-General has considered the results of the recent television demonstration, in conjunction with the British Broadcasting Corporation and his technical advisers, and he has reached the following conclusions which accord generally with the opinions of those who witnessed the demonstration. The demonstration showed that the Baird system was capable on that occasion of producing with sufficient clearness to be recognised the features and movements of persons posed for the purpose at the transmitting point. It is not at present practicable to reproduce simultaneously more than perhaps two or three individuals or to exhibit any scene or performance which cannot be staged within a space of a few feet in very close proximity to the transmitting apparatus.

### "Present Limited Scope."

In the Postmaster-General's opinion the system represents a noteworthy scientific achievement; but he does not consider that at the present stage of development television could be included in the broadcasting programmes within the broadcasting hours. He bases this view not so much upon the quality of the reproduction which further experiments may be expected to improve, as upon the present limited scope of the objects which can be reproduced.

The Postmaster-General is, however, anxious that facilities should be afforded, so far as is practicable without impairing the broadcasting service, for continued and progressive experiments with the Baird apparatus, and he would assent to a station of the British Broadcasting Corporation being utilised for this purpose outside broadcasting hours. He understands that the Corporation would agree in principle to this course, provided satisfactory terms were negotiated between the Corporation and the Baird Company.

### The "Experimental Demonstrations."

It will probably be essential that any experimental demonstrations of television should be accompanied by the broadcasting of speech and, in consequence, two wave-lengths and two transmitters would be required. It will not be possible to provide a second transmitter in a suitable locality which will avoid interference with important wireless services in Central London until the completion of the new station of the British Broadcasting Corporation at Brookman's Park, which is expected to be ready in July. In the meantime, it is suggested that the Company should open negotiations with the Corporation as to the financial and other arrangements which may be necessary, and it would probably be advantageous to them to enter upon discussions of the technical aspects with the Corporation's Chief Engineer.

In order to find room for a television service in broadcasting hours it will probably be necessary to utilise for the reproduction of vision wave-lengths outside the bands

now being used for speech broadcasting. These bands, as you are doubtless aware, are already highly congested, and it is important therefore that the Company should press on with experiments on a much lower band which will be notified to you in due course.

In conclusion, it is necessary to emphasise that in granting facilities for experimental demonstrations in which the public can if they so desire take part, neither the Postmaster-General nor the British Broadcasting Corporation accept any responsibility for the quality of the transmission or for the results obtained. The object of the demonstrations is to afford the Baird Company a wider opportunity than they at present possess for developing the possibilities of their system of television and for extending the scope and improving the quality of the reproductions. While the Company will not be precluded from selling apparatus to anyone who desires to purchase it, the purchaser must understand that he buys at his own risk at a time when the system has not reached a sufficiently advanced stage to warrant its occupying a place in the broadcasting programmes.

Sir,

Your obedient Servant,  
(Signed) G. E. P. MURRAY.  
General Post Office. March 27th, 1929.

## TECHNICAL NOTES.

(Continued from page 152.)

It is not necessary to injure or disfigure the pianoforte case in any way, the unit being, of course, attached at the back. In almost every pianoforte you will find at the back some exposed piece of woodwork into which it is a simple matter to drill a very tiny hole for the insertion of the screw of the loud-speaker movement.

### No "Booming."

I notice that a correspondent, writing in this journal a week or two ago, stated that he had mounted the unit on a separate strip of hardwood and wedged this firmly into position between a pair of vertical members of the main pianoforte frame, the stylus being pressed firmly against the back of the soundboard.

In this case also the tone was stated to be very good throughout the whole of the pianoforte scale and the bass notes, whilst being clear and well defined, were free from the "boom" which so often characterises them when reproduced by a loud speaker.

### Short-Wave Troubles.

When using a short-wave set, you will sometimes find it convenient to have the set very slightly in oscillation while searching for stations. This does not mean that you should allow the set to continue in oscillation after you have picked up the

carrier-wave which you are seeking, and the moment this is done you should reduce the reaction and make the corresponding readjustment on the grid tuning condenser. The reaction may then be brought up to a point just below oscillation.

Fine adjustment of the oscillation is very important if the short-wave set is to give satisfactory results, and, if you are troubled with the set jumping into oscillation and being generally unmanageable from that aspect, it is worth while trying out certain simple adjustments.

### Connections.

One thing which you might try is a higher value of grid leak. This will probably have the desired effect upon the oscillation, but, if not, the grid leak may be disconnected from the positive low-tension terminal and connected instead to the slider of a potentiometer which is connected across the L.T. supply. It will, then, be necessary to find a position of the slider on the potentiometer which will give smooth reaction control. Generally this should be found easily, but if difficulty should be experienced then a third dodge may be tried.

The high-frequency choke may require attention and a suitable choke can be made from fine enamelled wire wound in a single layer upon an ebonite or prepared cardboard tube. If the tubing is about 1 in. in diameter the coil should consist generally of about 60 to 80 turns, although this will need some slight variation in particular cases.

### Unsuitable Transformer.

The foregoing points are well worth keeping in mind and will certainly go a long way towards the control and satisfactory working of your short-wave set. There is one final matter which may be mentioned, and that is the low-frequency transformer which follows the rectifier.

Sometimes you will have trouble owing to this transformer not being of a suitable type, and in such cases it is worth while trying a variable grid leak across the secondary of the transformer; often this will have quite a surprising effect upon the operation of the set.

### "Coated Filaments."

I have before me a paper entitled "The Development of the Oxide-Coated Filament," by Dr. B. Hodgson and Messrs. L. S. Harley and O. S. Pratt, read recently before the Institution of Electrical Engineers.

The Paper reviews the development of the oxide-coated filament, and describes in rough outline present-day methods of manufacture for commercial purposes. It indicates also the most recent views on the mechanism of the electron emission from alkaline earth oxides.

### Theory of Operation.

The development of the oxide-coated type of cathode has been going on now for the past twenty-five years, and various theories of its operation have been advanced. The three-electrode valve, which was invented in 1906 by Dr. de Forest, was installed in 1914—only eight years after its discovery—in the telephone system of the United States, so that by 1914 it was possible to telephone across the Continent from New York to San Francisco. The valves used in the telephone repeaters had oxide-coated filaments.

A GREAT deal is written these days about harmonics, but to many of us they are still rather mysterious things, which we cannot properly understand, and the name of which may suggest anything from musical theory to the motion of a clock pendulum. Moreover, although we may be vaguely aware that harmonics exist, many of us are in doubt as to whether their presence in wireless reproduction is a blessing or a curse, or whether they really matter at all.

If we are quite clear in our minds as to what constitutes a musical note, however, our difficulty disappears.

An audible note is caused by the air vibrating in such a way that changes of pressure are produced in the ear. If the air vibrations occur sufficiently rapidly—much more rapidly than we can count—the effect of a note is produced.

#### Why Sounds Differ.

Let us take as a standard note, "middle C" on the piano. When this note is struck, the string inside the piano vibrates about 256 times per second. The air surrounding it, the case of the piano, the air in the room, and finally the organs of the ear are all vibrated at the same rapidity, with the result that the note is heard.

Now, similar results might have been produced by vibrating the string of a violin, or the diaphragm of a headphone, or the cone of a loud speaker—in fact, any object which could set the air in motion. We know, however, that notes produced by these various sources, even though we call them the same note (middle C), sound different from one another.

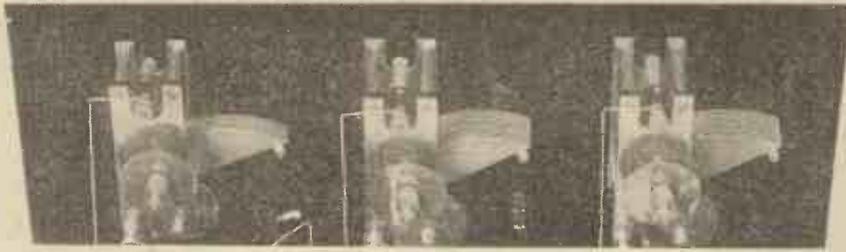
This difference is due to the presence of harmonics.

Reverting to the case of the note on the piano, when the string is vibrated it does not only move as a whole, but little ripples run up and down it from the point at which it is struck and these send out impulses into the air, along with the main vibrations. They are, however, much weaker and much more rapid, and give rise to higher pitched notes, for the pitch of a note depends directly upon the rapidity of the vibrations which produce it.

#### Harmonics are Essential.

There are several sets of these subsidiary vibrations produced, one set occurring with twice the rapidity of the original, another with three times the rapidity, and so on. These sets of vibrations are known respectively as the 2nd, 3rd, etc., harmonics of the original note.

It is the difference between the relative strengths of these harmonics which produces the difference between various types of instrument, as pointed out above, and a correct proportioning of harmonics is very necessary for a true rendering of music. Musicians refer to harmonics as "overtones," and it is these which give to a violin, for example, its beautiful tone.



## HARMONICS AND CYCLES.

An interesting article concerning two important radio terms.

By C. E. FIELD, B.Sc.

Listeners hear what is probably a close approach to a note without any harmonics in the nightly "pips" at the 9 o'clock time signal, and surely nothing could be more colourless than those notes!

Since harmonics are so important in the production of music, it is essential that wireless sets and loud speakers should be able to reproduce them. Thus, in order to render "middle C," a receiver and speaker must be able to amplify and reproduce not only vibrations occurring at the rate of 250 per second, but also those occurring at rates of 500, 1,000, 1,500, 2,000, etc., per second, and it is for this reason that we strive to make our sets deal faithfully with very high notes.

Harmonics can also mar good reception. For example, when a valve overloads, a disproportionate volume of harmonics is produced giving rise to harshness, with which we are all too familiar.

Harmonics, then, are not merely conceptions of the physicist, and of academic interest only, but are very real factors in our radio reproduction, and should constantly be borne in mind.

And now we come to the term "cycle,"

ward at a speed which increases to a maximum value, and then decreases until finally it stops, and then, moving back again at an increasing and then a decreasing speed. When the piston has finally returned to the point from which it started, a cycle has been completed.

If we substitute for the movement of the piston a movement, or current, of electricity, we have an exact electrical analogy. A current which commences to flow in one direction, increasing to a maximum value and then dying away, stopping and reversing its direction, at first increasing and then decreasing until it finally comes again to zero, completes one cycle.

#### Frequency and Wave-length.

This is what all alternating, oscillating, and wireless speech currents are doing continually—increasing, decreasing, stopping, reversing and again increasing, decreasing and stopping.

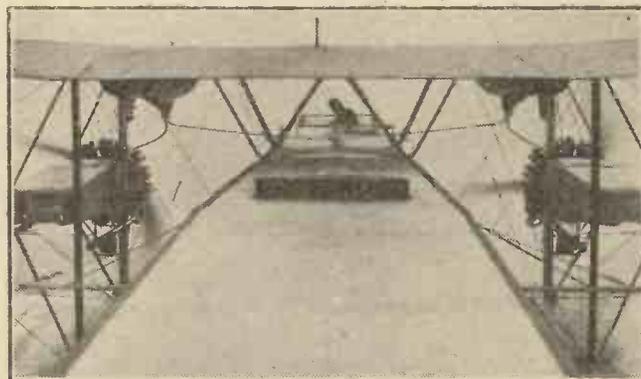
The time taken to complete one cycle is called a *period*, and the number of times that the series of changes takes place in a second is called the number of "cycles per second" or "periods per second," and is referred to briefly as the "frequency" of the current.

"Frequency" is always cropping up in wireless work. For instance, it is the frequency of the vibrations sent through the ether which determines the wave-length of the signals transmitted, a high frequency (i.e. a large number of cycles per second) corresponding to a short wave-length and vice versa.

When we wish to discuss music in connection with wireless,

it is convenient to think in terms of the frequencies of notes rather than of their musical pitch, for when we know the frequency of a note we know how it will be dealt with by different types of circuit. A note can be expressed as a frequency, for any note is produced by air vibrations, or cycles occurring so many times per second.

Inside a wireless set, the note is produced not by air vibrations, but by electrical vibrations (i.e. alternating currents) at the same frequency.



An original view of an Imperial Airways liner in flight, taken from the tail of the machine and looking along the fuselage. New wireless aerials from wing tips to tail are now being used on these liners.

so often heard in connection with wave-length measurements.

It is almost impossible to find a wireless article in which no reference is made either to "cycles per second," "periods per second," or at any rate, to "frequencies" of one sort or another.

The reason for the use of the term "cycle" in wireless matters is simple enough. The name "cycle" is, of course, applied to any series of events which occurs regularly.

A well-known example in engineering

# The P.M.G. and Television.

An important official announcement has recently been made, and is here reviewed for the benefit of our readers.

By THE EDITOR.

THE official communication from the Postmaster-General in connection with a recent television test, which our readers will find in another part of this issue, is a curious document. In it, the Postmaster-General quite rightly says of the Baird system that it is a noteworthy scientific achievement, but he goes on to say that he does not consider at the present state of development that television could be included in the broadcasting programmes within broadcasting hours.

## Broadcasting Facilities.

He bases this view not so much upon the quality of the reproduction by the television receiver, which he anticipates that further experiments will improve, but upon the limited scope of the objects which can be reproduced. Nevertheless, the Postmaster-General is of the opinion that facilities should be afforded so far as is practicable without impairing the broadcasting service for continued and progressive experiments with the Baird apparatus, and he himself would give permission for a station of the B.B.C. to be used for this purpose outside broadcasting hours.

We may thus regard it as definite that television experiments outside broadcasting hours will shortly begin. In fact, we are informed on excellent authority that these experiments may commence in July, and that they will in all probability continue for twelve months. Should progress be satisfactory and public demand warrant it, limited television transmissions will pro-

bably be included in the programme service similar to the arrangement now arrived at by the B.B.C. with Wireless Pictures, Ltd.

The Postmaster-General continues in his communique to point out that in order to find room for a television service in broadcasting hours, it may be necessary to utilise wave-lengths outside the bands now being used for special broadcasting. This opens up possibilities about a complete revision of broadcasting wave-lengths, and it would be interesting to know the unofficial views of the B.B.C. on the question of the regional stations and their future, in view of the Postmaster-General's pretty clear indication of his views with regard to television.

The Postmaster-General cautiously concludes his communique by pointing out that it is necessary to emphasise that in granting facilities for experimental television demonstrations, in which the public can, if they so desire, take part, neither the Postmaster-General nor the B.B.C. accepts any responsibility for the quality of the transmissions or for the results obtained. The object of the demonstrations is purely to afford the Baird Company wider opportunities than they at present possess for developing the possibilities of their system.

It is noted that while the company are not precluded from selling apparatus to anyone who desires to purchase it, the purchaser must understand that he buys it at his own risk at a time—and here is the significant conclusion to the Postmaster-General's letter—when the system has not reached a sufficiently advanced stage to

warrant it occupying a place in the broadcasting programmes.

## Valuable Stimulant to B.B.C.

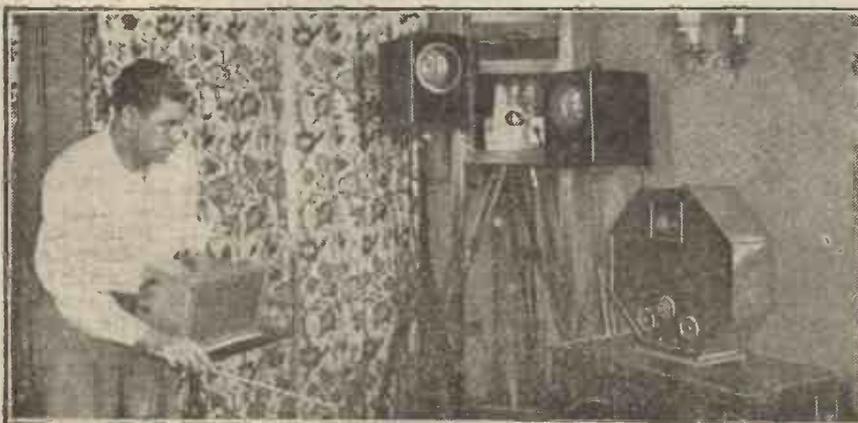
Nevertheless, despite enthusiastic supporters of television who have worked themselves at times into a very fine rage over the criticisms of television which have appeared in this and our contemporary journals, and who have accused us on more than one occasion of doing our best to crab television, and to display antagonism to Mr. Baird and his associates, we take this opportunity of congratulating Mr. Baird and Captain Hutchinson, his managing director, on the generally successful result of the recent test, and to express the hope that if and when facilities are given them for experimental broadcast transmissions, some practical solution to the wave-length difficulty will soon be found and that on the whole progress will be made satisfactorily enough to warrant the B.B.C. including television transmissions in regular programme hours in due course.

Should the Baird system, or, for that matter, any other television system, be brought to such a test of technical practicability which would warrant the B.B.C. making regular broadcast television transmissions in programme hours, broadcasting in general would receive a great fillip. The trade would benefit, public interest would be revised, and a new and very intriguing aspect of wireless technique would be opened up for the general amateur.

## A Sound Proposition.

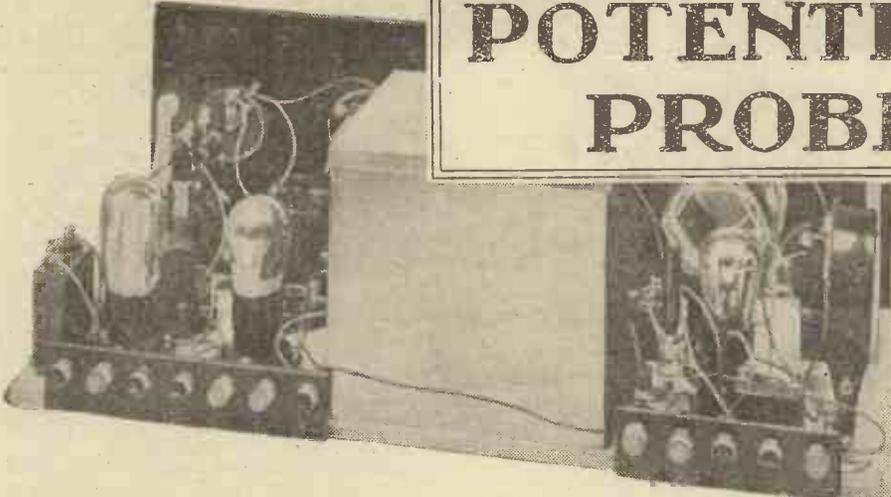
Our view all along has been that to provide the public with a television service before, to use a colloquialism, "it is ripe," would be to kill the goose that might lay the golden egg. But nursing and experimenting and improving a system more and more enhances the likelihood of its warm reception by the public; whereas if something in an embryo stage is placed before the public, its popularity is damned at birth and, although progress may be made later on, the first unfavourable impression takes a lot of wiping out.

The recommendations of the Postmaster-General seem to be eminently satisfactory, inasmuch as they suggest at least twelve months' experimental transmission outside broadcasting programme hours with every likelihood, if progress is made, of a definite inclusion of television in B.B.C. programmes.



Of the American broadcasting stations, that at Schenectady, W G V, is paying most attention to Television, and this photograph shows W G V's Director of Television Drama at work.

# POTENTIOMETER PROBLEMS



What exactly is the potentiometer, and what should it do? In this article the use of this valuable device is clearly explained.  
By C. E. FIELD, B.Sc.

THE importance of potentiometers is perhaps not generally recognised, and many owners of home-made wireless receivers fight rather shy of using them simply because they are not quite sure how they work, and whether they are ever really worth while, and not merely refinements.

There are, however, many uses to which a potentiometer can be put, and in several up-to-date circuits they are just as necessary as rheostats or tuning coils.

We could obviously take any point on the resistance between A and B, and in a similar way find the voltage at that point with respect to each end of the resistance, and the conclusion at which we should arrive, and at which readers have probably arrived already, is that the voltage between any two points (such as A and C) is directly proportional to the resistance of that portion.

Clearly, then, by means of a resistance from which a tapping can be taken off at any point between the two ends, we can obtain any fraction of the full voltage which is applied to the whole resistance.

This arrangement constitutes a potentiometer, but on account of the many different uses which can be made of it, its mechanical construction varies considerably.

### Getting Correct Bias.

Let us take one or two examples. In the circuit shown in Fig. 2 (a) we have a valve receiving signals from the aerial circuit, and it will be seen that the valve in question is operating as an anode-bend detector, biased with a 3-volt battery connected between its grid and filament negative. If this voltage were found to be insufficient, we might increase it by moving our wander-plug to the next tapping on the battery, giving a bias of  $4\frac{1}{2}$  volts.

Suppose, now, that we had reason to believe that  $4\frac{1}{2}$  volts was too much, and that for the best possible results we needed a bias of somewhere round about  $3\frac{1}{2}$  volts. This is a case where a potentiometer would come in extremely useful, for by connecting it across the ends of the valve filament, or of the low-tension battery, which we will assume to be of the 2-volt type, we could vary the grid-battery voltage by any amount up to 2 volts.

This is shown carried out in Fig. 2 (b), where it will be seen that a  $4\frac{1}{2}$ -volt grid battery is employed, and is connected, not directly to the filament negative, but to a slider which can make contact with any point on a resistance joined across the ends of the valve filament. If we set the slider at about the middle of this resistance, then its potential is 1 volt more positive than the negative end of the filament, and therefore the bias voltage of  $4\frac{1}{2}$  is reduced by this amount, giving the required value of  $3\frac{1}{2}$  volts.

Referring to Fig. 1 (a) we have, let us say, a voltage of 6 at the point A and a voltage of 0 at B, giving a difference of 6 volts between the ends of the resistance.

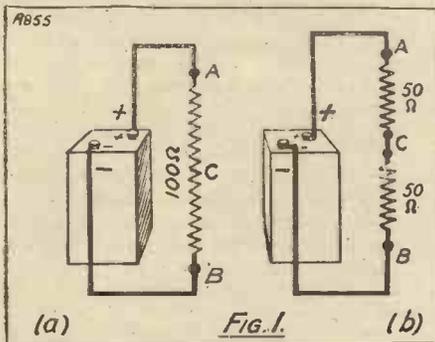
Now, what about the voltage conditions at any other point in the circuit, such as the point C midway between A and B? We might make a guess and say that the voltage would be half way between that at A and that at B, and we should be perfectly right. In order to see that this is so, we can imagine that instead of having one continuous resistance from A to B, we have two separate resistances each of 50 ohms, connected end to end, one from A to C and the other from C to B—Fig. 1 (b).

### Suitable Resistance Values.

The voltage required to drive current from, say, A to C, will be half that required to drive the same current all the way from A to B, the other half of the available 6 volts being expended in driving current from C to B. Thus our guess was quite correct.

Let us take another case, and suppose that a point C is taken such that the resistances between A and C, and C and B are 25 ohms and 75 ohms respectively. That is to say, C is one quarter of the way along the resistance from A to B. Then, using the same argument as before, we can

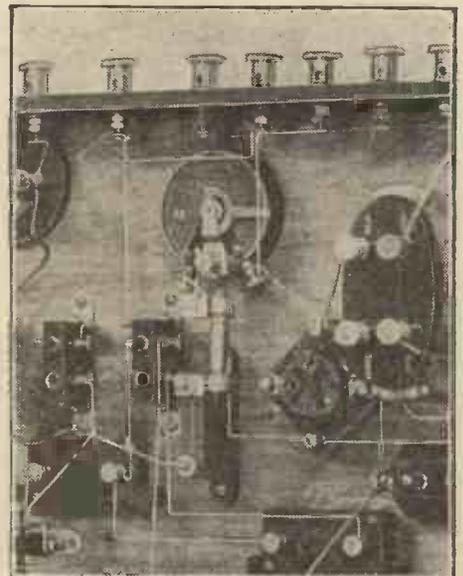
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The name *potentiometer* is perhaps a little fearsome, so let us understand just what the device is supposed to do, before reviewing one or two of the more important uses that may be made of it.

### "Splitting" Voltages.

Let us suppose that we have a 6-volt battery, and a resistance of, say, 100 ohms. From what we all know about batteries, voltages, and so forth, we assume that one terminal of the battery, the positive, differs in pressure (which is another name for voltage) from the negative terminal, by 6 volts, and we know that if the terminals are joined by a piece of wire, a current will flow along this from one to the other. If, then, in place of a plain piece of wire, we substitute the 100-ohm resistance, as shown diagrammatically in Fig. 1 (a), a current will flow along the resistance wire, and if we wanted to know the value of this current we could easily calculate it by dividing the voltage by the resistance. For the present, however, we are not interested in the value of the current, but only in potentials or voltages.



A potentiometer in use in a set for the purpose of providing accurate grid voltage on the detector valve.

## POTENTIOMETER PROBLEMS.

(Continued from previous page.)

say that the total resistance may be regarded as two separate units connected end to end, with the same current flowing through each.

The voltage required to drive the current through the 25-ohm portion will evidently be only one-third of that required on the 75 ohms, and if we keep to our assumption that the voltage at A is 6 volts, and that at B is 0, then C is at a voltage of  $4\frac{1}{2}$ , i.e. it is  $1\frac{1}{2}$  volts below A and  $4\frac{1}{2}$  volts above B. If a high-resistance voltmeter were connected between A and C and between B and C, voltages of  $1\frac{1}{2}$  and  $4\frac{1}{2}$  respectively would be registered.

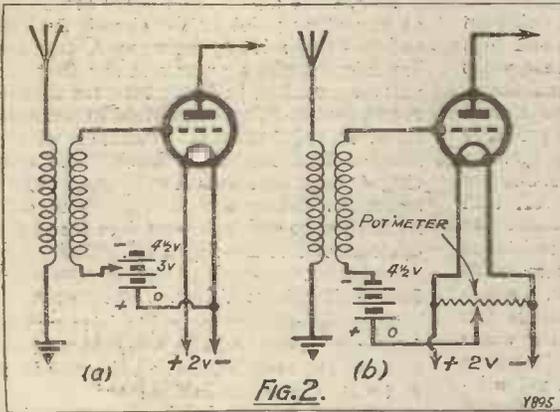


FIG. 2.

The value of the whole resistance does not matter a great deal within very wide limits, but it must not be too low, for a current is flowing through it continuously from the filament battery, and, of course, the lower the resistance the higher the current. A very usual value is 400 ohms, this being a suitable resistance for winding with bare wire in the manner of the filament rheostats with which we are all familiar.

### Volume Control.

Now take the case in which signals received by a valve from a preceding amplifier are too strong to be handled without overloading, and consequently it is desired to reduce the signal strength, without de-tuning the set. Here again the potentiometer comes to the rescue, for we can tap off from it any portion we like of the voltage available from the preceding valve, by using connections similar to those shown in Fig. 3, which assumes transformer coupling.

The potentiometer consists of a resistance connected across the secondary winding of the transformer (i.e. across the full signal voltage) with an adjustable tapping taken to the following grid. Thus referring to the diagram, if the resistance from A to C is, for example, one quarter of the total resistance A-B, then only one quarter of the signal strength available from the transformer is actually applied to the valve grid.

In this case the potentiometer requires to have a very high resistance, for if the value were only, say, 400 ohms, as in the case of the circuit shown in Fig. 2 (b), it

would behave almost as a short-circuit on the transformer. A suitable value is about half-a-megohm, so arranged that the portion A-C can be reduced, if required, to perhaps 5,000 ohms. There are several types of suitable potentiometers for this purpose on the market, employing either a continuously variable element or a series of high resistances each connected to a stud of a multi-point switch.

In battery eliminators, potentiometers often play a very important part. Take, for example, the circuit given in Fig. 4, which incorporates the last valve of a receiving set, and a simple A.C. mains unit. Three potentiometers,  $P_1$ ,  $P_2$ , and  $P_3$  are shown.

### Eliminating A.C. Hum.

$P_1$ , which is connected across the ends of the filament of the power valve, might appear at first sight to be serving the same purpose as that shown in Fig. 2 (b), but this is not so. It will be seen that the valve filament is fed with alternating current, which means that although at one moment the left-hand end is positive and the right-hand end is negative, these polarities are reversing fifty times a second.

If the lead from the grid battery were taken to the negative end of the filament in the ordinary way, the bias would be varied by the alternating voltage, especially if the positive end of the filament were earthed. The effect would be just as if a signal with a frequency of the alternating-current mains were applied to the grid, and the set would hum.

Now, although the voltage between the two ends is always reversing, the potential of the middle point of the filament will remain fixed at a value midway between those of the extremities, and if the grid lead is connected to this point no hum will be heard. As we cannot get at this mid-point, the potentiometer  $P_1$  is connected as shown, and the grid lead, being connected to the movable tapping, can be adjusted until the mid-point is found and the hum is reduced to a minimum.

The second potentiometer,  $P_2$ , is not so essential as  $P_1$ , but is sometimes helpful in removing the last traces of hum, especially if the rectifier is a 6-volt valve, and the smoothing circuit leaves something to be desired. Here our object is again to get at a point which lies at a potential midway between the ends of the valve filament, which is heated by alternating current, in order to prevent the ripple which this time finds its way directly into the loud speaker valve as in the circuit in which  $P_1$  is employed.

Both  $P_1$  and  $P_2$  can be similar in value and type to the potentiometer shown in Fig. 2 (b).

The third potentiometer,  $P_3$ , serves an entirely different purpose, being used to provide different values of high-tension voltage for the different valves in the receiver.

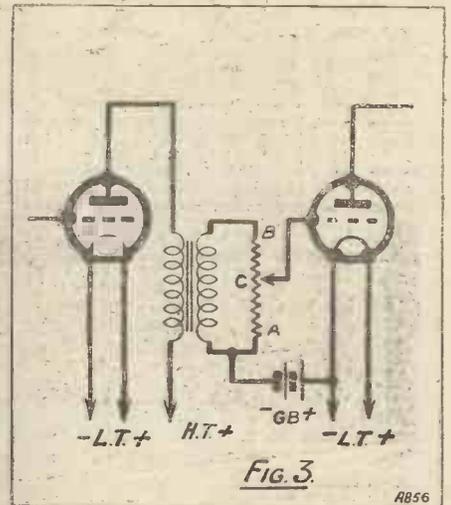


FIG. 3.

When a dry battery is employed for supplying H.T. current, various voltages can be obtained by means of battery tappings. In Fig. 4, A and B are the terminals of the "battery," and in order to obtain various voltages, a high resistance is connected between these points; and tappings, C, D, etc., are taken from intermediate positions.

### Alternative H.T. Voltage-Tappings.

Strictly speaking, this is not a potentiometer, but something between that and a rheostat, because some of the resistances are directly in series with the anode currents being supplied. For instance, if the resistance, A-C is one quarter of that between A and B, and the total voltage is 200, the potential difference between C and B will be 150 volts.

Any current flowing to a valve connected to C, however, must pass along A C, with the result that the voltage at C is still further reduced by the amount spent in driving the current through this resistance, which, of course, depends upon the value of the current.

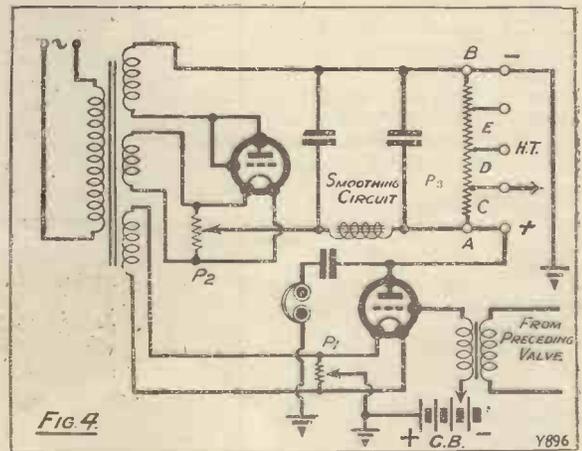


FIG. 4.

The manner in which the potential is distributed thus depends largely upon the types of valve which are being fed with current, and it is therefore desirable, if possible, to design the potentiometer to fit the particular circuit employed. Four or five steps of 4,000 ohms each provide a very useful control.

# PHILIPS LOUDSPEAKERS



Here are the finest Loud Speakers yet produced—  
without one you have never heard radio as it really is.  
Hear one of these Speakers to-day; it will be a revelation.  
Philips Loud Speakers have a world-wide reputation  
behind them.

TYPE 2007, supplied in three different colours :

Orange, black and gold	} £5.5.0
Violet, black and gold	
Brown, black and gold	

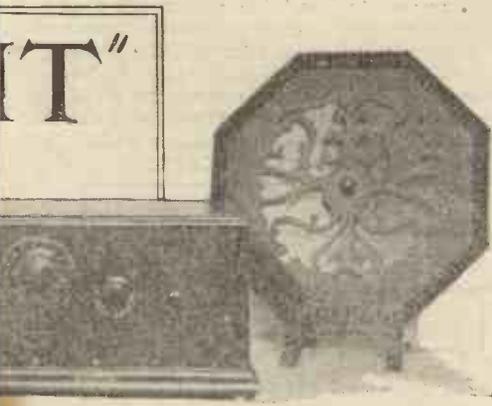
TYPE 2016, Mottled Red - - - - 50/-

TYPE 2026, Grey - - - - 50/-

# PHILIPS

*for Radio*





This, however, is not the case, as a close study of the theoretical circuit diagram will prove. It will be seen that a very ingenious scheme is employed, in which the reaction coil is also used as an aerial coupling coil.

At first this may appear to have the drawback that the best size aerial coupling coil may be either too large or too small for smooth reaction control.

This possible difficulty is overcome by providing a series aerial condenser, which may be put in and out of circuit by changing the aerial lead from one terminal to another, and also by providing a separate H.T. tap for the detector valve.

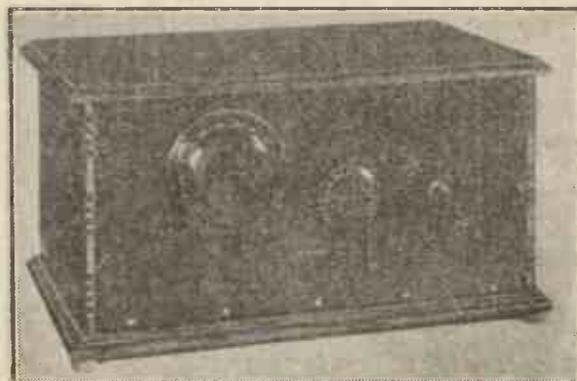
You get as high a degree of selectivity on the higher wave-band as you do on the lower with this easy-to-build and powerful set.

Designed and described by A. S. CLARK "P.W." Technical Staff.

By adjusting the H.T. voltage on the detector valve it is possible to alter the ease with which it will oscillate, thus altering the size of coil which will work best as reaction. In actual practice, I have had no difficulty whatever in choosing suitable coils, which will give good signal strength at both ends of the tuning dial, and which give a smooth control of reaction round the whole dial.

**Smooth Reaction Control.**

With reference to smooth reaction control, the set seems to be very good in this way, gradual control being obtained even with voltages as high as 90 and 100



on the detector valve. This is, of course, accounted for to some extent by the fact that the detector valve is followed by an R.C. stage.

One end of all four coils is common, and the change-over switch merely connects the aerial and tuning condenser to the desired set of inductances. Reaction is controlled by means of a variable condenser in the usual manner.

As a matter of fact, the circuit is really one with Reinartz type reaction, in which the aerial is joined to one end of the reaction coil instead of to its own separate winding. Following the detector valve are two stages of low-frequency amplification, the first being coupled by the resistance-capacity method, and the second by means of an L.F. transformer.

The amplification from two such stages, especially when a really good L.F. transformer is employed, is very great, and is obtained with practically no distortion. It is thus possible with this set to obtain quite a number of stations at real loud-speaker strength with sufficiently good quality to make them really worth listening to. It will be noted the two sets of coils are arranged at right angles.

**Avoiding Coil Coupling.**

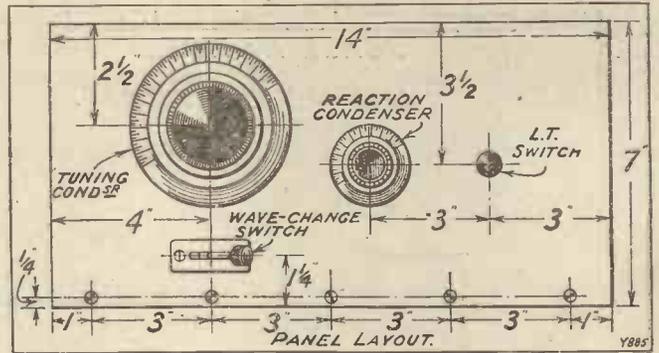
This is so that their fields will cut one another at right angles also, and thus there will be practically no coupling between them. Although it is not likely that trouble would be caused by the two sets of coils becoming coupled, since one set is always out of circuit, it is as well to be on the safe side. The coils were therefore placed at right angles, so that all possible loss of efficiency is obviated.

A list of all the components required to build this set will be found on the page opposite this one. The makes mentioned give an indication of what are suitable types and class of components.

It is not, however, necessary to keep to one of those mentioned, as other parts of good make and similar type may be employed. Actually, the set is not critical as far as components are concerned. The plug-in coils have not been included in the list, but suitable sizes are mentioned towards the end of this article.

**Constructional Details.**

The construction of the set is similar to that of most other straightforward receivers,

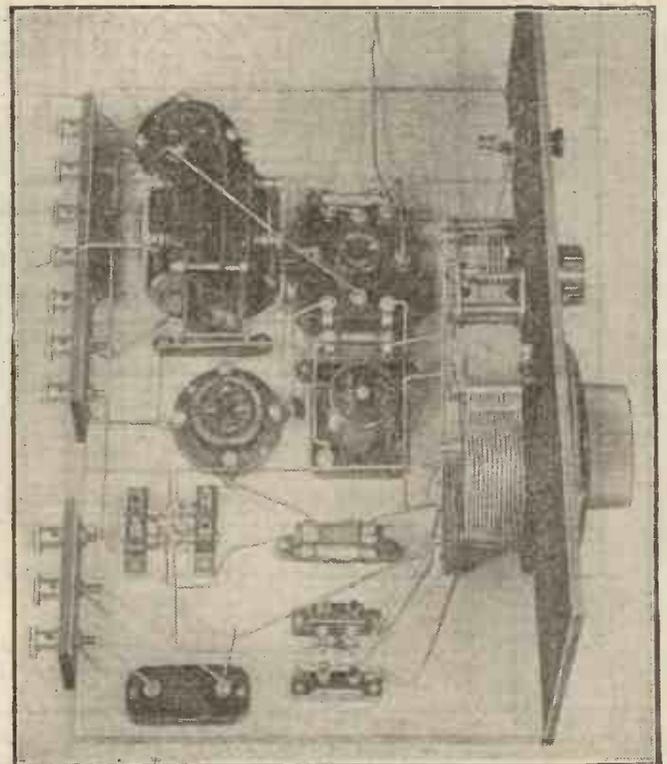


and there are no points which will be found to present difficulty.

First drill the panel in accordance with the drilling diagram, not forgetting to reverse the positions of the holes, since you will be marking out on the back of the panel.

The dimensions of the terminal strips can be obtained from the back-of-panel diagram. When all the drilling is completed, and the panel components and the terminals mounted, the panel and terminal strips can be screwed to the baseboard. If desired the terminal strip can be cut to run right along

(Continued on next page.)



The effective simplicity of both the front and back-of-panel designs of the "Tom-Tit" Three are clearly illustrated by these two photos.

★-----★  
**THE "TOM-TIT" THREE.**  
 (Continued from previous page.)  
 ★-----★

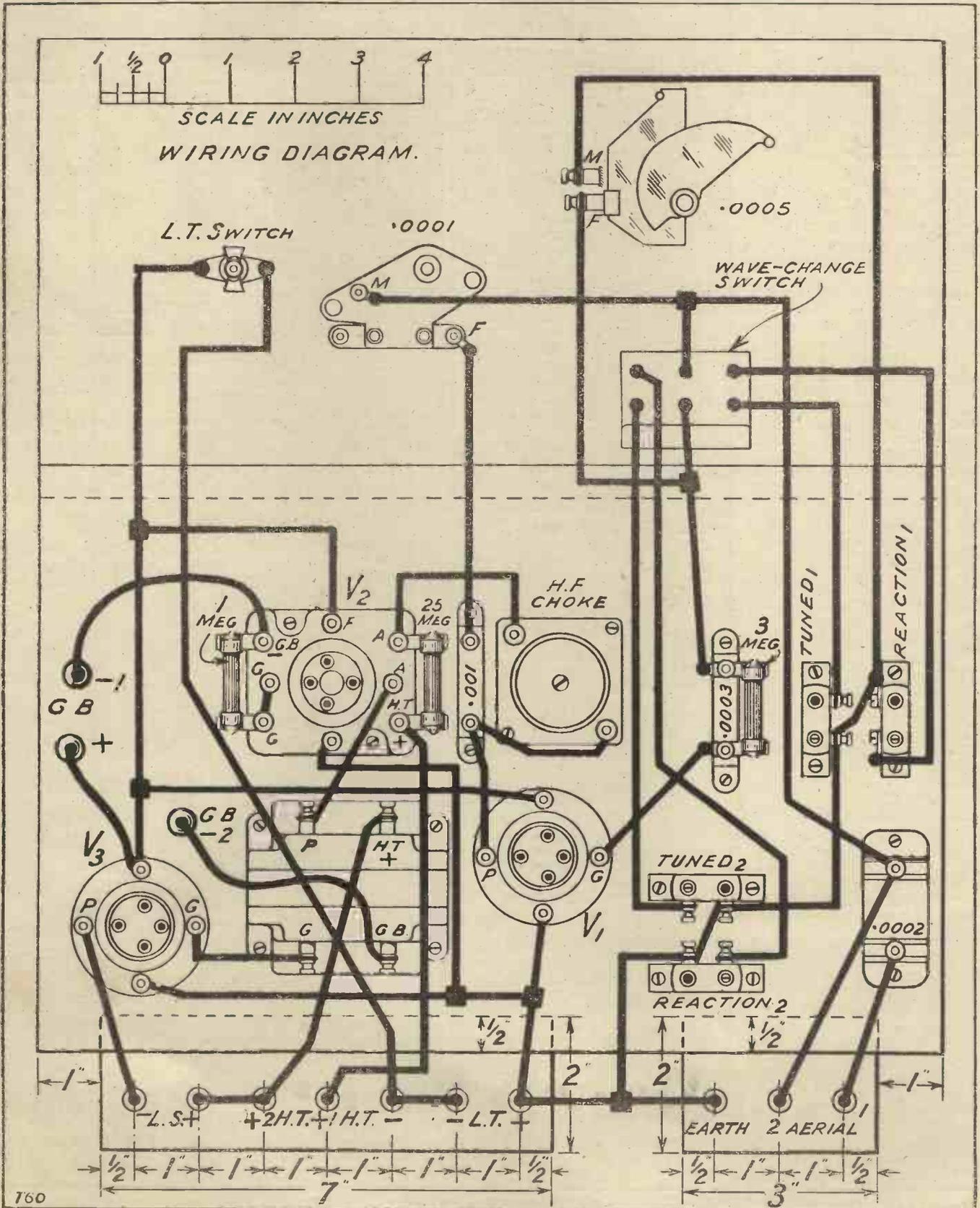
the back of the set instead of being in two pieces and leaving a gap between them.  
 Now mount the components which go on

the baseboard. When doing this you should follow the layout given in the back-of-panel diagram as far as possible. It is very important when fixing the coil mounts and first valve holder into position to see that these are so placed that the coils and valve will not touch.

To obviate any trouble in this direction,

it is as well to insert the coils and valve when finding the suitable positions of the coil mounts and valve holder on the baseboard. Do not forget that room has to be allowed at the left-hand end of the baseboard (looking at the set from the back) for two grid-bias batteries.

(Continued on page 174)



**THE "TITAN" THREE.**

The Editor, POPULAR WIRELESS.

Dear Sir,—Having just built up the "Titan" Three, I should like to thank you for a wonderful circuit, which is far and away better than anything I have ever handled.

Tuning in stations is simplicity itself—and the quality is excellent.

The opinions of my friends are all alike—that it is really a wonderful set.

One feels a trifle out of place when first handling a set which requires least reaction at the top of the scale, but this soon comes just as easy as the other way.

When I first built the set, I made my own coil unit, and although results were good on the long waves, I came to grief on the short, for as soon as I showed the slightest reaction to the signal, it vanished completely. There was a peculiar deadness and lack of power anywhere on the short waves. So I pulled the coil out, and rewound it, again observing all your directions to a fraction.

On inserting this coil, things were as before—deadness, and signals just audible L.S.

On putting in a professionally made coil, things were as I wrote earlier in this letter—simply fine.

Now, can you tell me where I blundered with that short-wave winding? Did I use thin spaces, and so get too tight a coupling?

You may guess I am curious on this point, especially since I was so careful to get the coil right, as I thought. Perhaps you will put me right.

Meantime, accept the good wishes of a regular reader, and my thanks for the "Titan."

Yours sincerely,

Hants. D. G. R.

[EDITORIAL NOTE.—The symptoms our correspondent reports seem to point very definitely to the primary winding having been in the wrong direction. This is rather a tricky little point if one has not had considerable experience of coil winding. With a correct primary it should appear to be a continuation of the secondary, working upwards from the bottom. Another way of regarding it is to look at the two upper ends of these windings; these ends point in opposite directions, as though they had been formed by cutting into one of the turns of a continuous winding.

This, of course, is the correct definition of two windings in the same direction, and is a point upon which many home constructors are not quite clear.]

The Editor, POPULAR WIRELESS.

Dear Sir,—As requested by you I beg to inform you that I have now received from Messrs. Paroussi a very efficient coil. The firm treated me very fairly and frankly admitted that the coil first supplied was wrongly wound. I gather there was some ambiguity in the instructions you first issued regarding the winding of these "Titan" coils, and that Messrs. Paroussi & Co. were not the only firm which went astray. However, whatever is the real story of the coil, the one I have is quite all right, and this set as a whole is extremely good. It is, of course, not very selective when compared with sets having more than one tuned circuit, but it is sufficiently selective for all ordinary purposes, while the quality of its reproduction is extraordinarily good. It separates Radió Paris from 5 X X on the long-wave belt; while on the shorter wave-band it separates 2 L O, Stuttgart, and Toulouse, and this is good enough for most of us. The "Titan" Three has here to keep its end up against a Marconi Straight Eight, and a Silver Marshall Six, and it does it extremely well. The other evening we took the Turin programme for an hour and a half, and the quality of the output was wonderful—in fact, quite up to the very high standard of the Silver Marshall, and that is saying a lot.

I know very little about wireless, but I know

**CORRESPONDENCE.**

**THE**

**"TITAN" THREE.**

**PIANO AS LOUD SPEAKER—  
WHITE PRINT No. 10—THE "P.W."  
"SUPER-SCREEN" THREE.**

Letters from readers discussing interesting and topical wireless events or recording unusual experiences, are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

enough to congratulate you on a really good receiver.

Yours faithfully,

A. D. G. SHELLEY.

Guildford.

[EDITORIAL NOTE.—We do not agree that error in producing the "Titan" coil can be attributed to any ambiguity in our specification. Every manufacturer has the opportunity of having his product tested and approved by ourselves, and this should enable him to be certain of an accurate model for production purposes.]

\* We would suggest to our correspondent that this is not quite a fair basis of comparison. Our claim for this set is that it is unusually selective for a type incorporating only one tuned circuit.

**THE "P.W." "SUPER-SCREEN" THREE.**

The Editor, POPULAR WIRELESS.

Dear Sir,—Having read what so many of your readers have to say about their sets that they have built has made me write to let you know about my set—the "Super-Screen-Grid" Three. Long may it reign and receive. It is the second receiver that I have built, and it is the admiration and envy of all my friends. I have an indifferent aerial slung between the chippies, but I can get over thirty stations on the loud speaker. I get Budapest, Katowice, Rome, Lyons, Madrid, Barcelona, and Nurnburg, among others. As for selectivity, I get 5 G B, Lyons, Langenberg, Milan, and Berlin absolutely clear of each other. Have also had Rabat, Morocco, on the speaker. I am using Cessor valves throughout—2-volts. Have all the stations charted, and the set is so easy to handle that my boy, aged nine, gets any station that they require when I am away. If there are any scinties they can come and listen to set any evening. While writing this we are listening to an operatic broadcast from Rome ("Pagliacci"). One thing I would like you to do, and that is—devise some means to utilise dual-range coils so as to do away with coil changing and make the set "super perfect." I might say that I built the cabinet myself with sixpenny wood, and it holds the batteries and accumulator; 22 in. by 16 in. by 10 in.

Wishing you every success and more circuits like above.

Yours faithfully,

JOSEPH LITMAN.

Brighton.

**THE "TITAN" COIL.**

The Editor, POPULAR WIRELESS.

Dear Sir,—Having tried out three or four circuits incorporating your standard broadcast wave and loading coils, I have found out that by taking the bottom end of the aerial winding to the 216-turn

connection instead of the O connection on the loading coil, I get louder signals by far than when I connect up as per your diagrams. This method in no way alters the short-wave connections or circuit, but on long waves brings the aerial tap to the grid end of the coil instead of the earth end, as in your method. I wonder if any POPULAR WIRELESS reader has done a similar thing and got improved reception? I am going to try the change-over out on a Standard "Titan" Coil unit working in a "Titan" Three set, to see if I can get more volume on the long waves, although there is volume and stations enough to satisfy most people, I should think. Congratulations to you on having turned out such a fine set. Would a neutralised H.F. valve work in place of the screened-grid and give moderate results?

Yours truly,

J. OWENS.

Co. Durham.

[EDITORIAL NOTE.—This is an interesting example of what can be done in specially favoured localities where selectivity is not a serious consideration, and a good deal can be sacrificed to get sensitivity. What our correspondent does, of course, is in effect to connect the circuit to the older form of direct-coupled aerial arrangement, which may give sufficient selectivity for such localities as his, but would scarcely be adequate when the user has to contend with the "local station" problem.

Regarding our correspondent's final inquiry: this would be very difficult, and would involve a good deal of drastic alteration.

**PIANO AS LOUD SPEAKER.**

The Editor, POPULAR WIRELESS.

Dear Sir,—I have read in the current issue of POPULAR WIRELESS a letter from your correspondent, Herbert A. Bower, concerning the use of his piano as loud speaker. I would like to mention, however, that although your correspondent says that there is no trace of "boominess" on the low notes, this is most likely caused by the natural sympathetic quality of the piano strings, which would have the effect of giving the real notes more definition. Therefore, the reproduction he is now getting cannot, of course, be true.

To illustrate my argument I suggest that your correspondent should sing on to the piano strings and then stop suddenly. He will notice the piano actually reproduces the same note as he himself was singing. This peculiar property is known as resonance, and, as will be seen, is apt to be rather misleading.

Yours truly,

S. F. DUNMORE.

E.I.

**LOOPING THE LOOP.**

The Editor, POPULAR WIRELESS.

Dear Sir.—When will some enterprising individual market a simple tool for making loops in the ends of wires? In the days when piano wire was the principle ingredient in making aeroplanes I distinctly remember coming across a pair of "pliers" which did the job "in one." What about it?

Yours faithfully,

G. M. PART.

Woking, Surrey.

**WHITE PRINT No. 10.**

The Editor, POPULAR WIRELESS.

Dear Sir,—Might I say, sir, I am very grateful for above. I am at present living about two and a half miles from Newcastle (S.N.O.). I can get now what I have been wanting for a long time. I have put in place of the r/shuttle resistance a potentiometer (300 ohms) and 0003 fixed for 0002, and I can work my speaker on 40-30 volts, (2-volt Mullard valves, L.F. and H.F.). The coils are 75 aerial and 80 reaction; tuned in with a 0008-mfd. condenser.

Roll them out more White Prints please.  
Newcastle-on-Tyne. WHITE PRINT.

**SHORT-WAVE  
NOTES.**

By W. L. S.

of this column. Please send in lists to "W. L. S.," c/o The Editor.

There are now at least four active telephony stations in Java, working on wave-lengths from 15 metres upwards. The old calls ANE, ANF, etc., have been changed to PLE, PLF, PLG and PLR. PLJ works on C.W. on about 19 metres, I believe. What a hive of activity Java seems to be for a relatively small part of the world. I think it must be that "that Philips feeling" is the cause of it all!

I am collecting all the data I can on the

regular broadcast transmissions on short waves, and here again I should greatly welcome any information that readers can forward. It is quite impossible for me to listen for 24 hours every day, and it is certain for this reason that someone or other will have at some time picked up an interesting transmission that I must have missed.

Incidentally, there are rather few short-wave broadcasts that can really be termed "regular" nowadays. Doubtless things will improve in this direction later on, but all schedules seem to be broken up from time to time without previous notice.

Naturally, on short waves it is impossible to arrange a schedule that can be usefully kept all the year round, on account of the variation in the best time for reaching any particular spot. It seems to me that future short-wave broadcasters will have to have a "sliding-scale" schedule, the variable factor being either time or wave-length.

I AM afraid the list of international prefixes that I gave a few weeks back was not perfectly complete or correct. Since its publication I have noticed the following discrepancies; Chile is apparently using CE, not CA; Uruguay has started using CX instead of CW; Peru has arrived on the air with the prefix OA; South Africa is using ZS, ZT and ZU; and India appears to be using both VT and VU.

Just to lend a spice of variety to the programme I thought I would put a small reception-test before our regular short-wave enthusiasts, in the following form who can claim to have heard the greatest number of British Colonies, Dominions and Protectorates?

I have an idea myself of the maximum number "hearable," and should be greatly interested to know whether anyone has reached it. The results should make interesting reading for regular followers

## FROM THE TECHNICAL EDITOR'S NOTE BOOK



## TWO NEW EKCO INSTRUMENTS.

As usual E. K. Cole, Ltd., of Leigh-on-Sea, are this year well in the van with mains devices, one of their latest productions being the "Ekco-lectric Straight Three." This receiver, which is supplied for either D.C. or A.C. mains, derives all its power from the light socket. No batteries of any kind are necessary.

You plug it into the mains just as you would an electric iron or carpet sweeper. It is in every way a very excellent proposition. First and most important, it is completely safe and conforms with the I.E.E. recommendations. It is enclosed within a metal casing and everything seems to have been done to eliminate possibility of accidental shocks.



The A.C. version of the new "Ekco" H.T. Unit.

The metal cabinet by the way, has an artistic dark brown crystalline finish having something of the appearance of art leather. It is quite a break-away from conventional practice, though none the less pleasing. The circuit is a Det., 2 L.F. (resistance and transformer), and it is interesting to note that a super-power valve is used in the last stage. The whole circuit appears to have been designed for quality reproduction. The controls embody two slow-motion dials, one for wave-length tuning and the other for reaction control. Sockets are fitted for a gramophone pick-up. A further refinement is the provision of a volume control.

The set will operate a moving-coil loud speaker on the local station or Daventry and, indeed, some of the more powerful continentals. By the way, we must not forget to mention that a wave-change switch is fitted enabling one to go over from 240-550 to 1,000-2,000 metres in an instant. The set is a remarkably stable one to handle and there is no hum. It has ample selectivity.

From all this you might gather that the outfit is a hundred-guinea model, and will

no doubt be surprised to learn that the D.C. type costs only 19 guineas, and the A.C. 21 guineas complete with valves and including royalties. This does, indeed, seem good value for money.

The other new Ekco production is an H.T. unit, the model 3 F.12. This unit is suitable for sets up to three valves, and its special feature is that it has a screened-grid H.T. tapping. It is just the sort of unit required for a set such as the "Titan" or the Cossor "Melody Maker."

It has three voltage tapplings, one of 60-volts at two milliamps, approximately, for the detector, another providing 120 to 150 volts for the L.F. stage and a low-current high-voltage tapping for the supply for a screened-grid valve. The price of the D.C. model is £1 17s. 6d.

The A.C. model costs £3 18s. 6d., and this employs a valve rectifier. We have tested the A.C. model and find it completely satisfactory in every way.

## COLUMBIA "LAYERBILT" BATTERIES.

Regarding the Columbia "Layerbilt" battery, to which we referred recently, we have received an interesting letter from Messrs. J. R. Morris explaining the novel construction in some detail.

"The standard type primary cell consists of a pressed zinc can in cylindrical form with a round carbon electrode placed in the centre, held in position by the usual mixture of depolariser, etc., and sealed with wax or pitch.

"On the other hand the 'Layerbilt' cell is constructed in flat form. It consists of a layer of zinc to which is annealed a thin layer of carbon forming the positive electrode. A thick layer of depolariser is then introduced and this is insulated from the zinc (negative) electrode by impregnated paper. To this zinc electrode is annealed the positive electrode of the next cell, and thus the battery of cells is built up without external connections of any description.

"By this construction a greater quantity of active material can be packed into a limited space and, of course, the possibility of internal high resistance through doubtful soldered connections is entirely eliminated. Undoubtedly the greatest advantage in this construction, however, is in the balancing of the quantities of elements.

"In a cylindrical cell the zinc electrode must necessarily act as a container, and

therefore the amount of zinc used is determined not so much by its electrical necessity as by the size of the cell. In the same way the carbon electrode, which in the cylindrical cell is a thin pencil, by the 'Layerbilt' construction is spread out into a thin sheet of equal surface area in opposition to the zinc electrode.

"These are the apparent differences, but, of course, there are other important points in the construction which we cannot briefly describe. The fact remains, however, that this 'Layerbilt' construction actually gives 35 to 52 per cent more service. In other words, if exactly the same quantities of materials were made up in flat and cylindrical form, the 'Layerbilt' battery would have 35-52 per cent greater capacity."

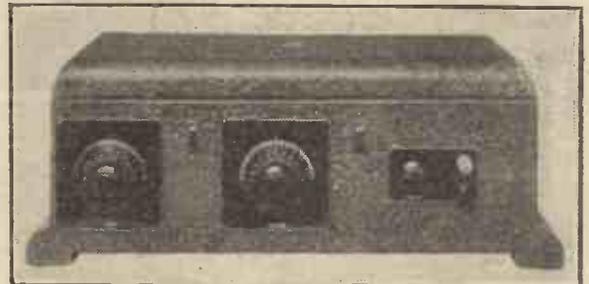
Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality, under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

## A DUAL RANGE COIL.

S. W. Scott & Co., radio tuner manufacturers, of Lothian Road, London, S.W.9, who will be remembered by "P.W." readers as regular "P.W." advertisers of an All-wave Tuner Unit, have produced a new line in the "Little Wonder" Dual Range Coil. This coil retails at 10s. 6d., including a push-pull switch and full instructions for fitting.

The coil is wound on a ribbed ebonite former. The low-wave winding is carried out in green silk wire, and the reaction and high wave in red silk-covered wire. The coil is very easily mounted on the baseboard by the two feet provided, and the six terminals are arranged around the base, accessibly but so positioned that the wires going to them can be set well down.

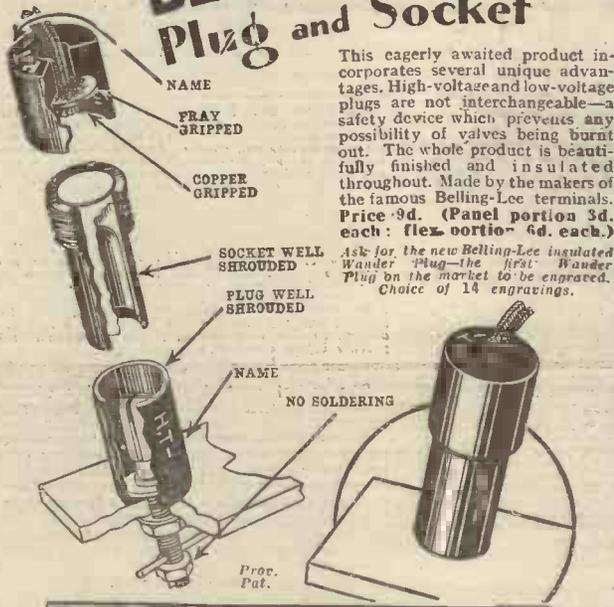
The aerial terminal is taken to a tapping on the low-wave coil. The wave-length ranges covered by this coil are 200 to 600 metres, and 1,000 to 2,000 metres. This is when a .0005 mfd. tuning condenser is used. It will be gathered from the fact that the over-all height is 4 in. and the diameter 3 in.



The "Ekco-lectric Straight Three," an "All-Mains" Receiver due to E. K. Cole, Ltd., which incorporates many modern refinements.

that it makes a very small and neat component. On test we found it quite satisfactory. There was good selectivity on the lower range, although the upper range showed a slight flatness, as was only to be expected. Fortunately, there is for the most part a moderately wide station separation on these lower frequencies.

# The Inside of the new BELLING-LEE Plug and Socket



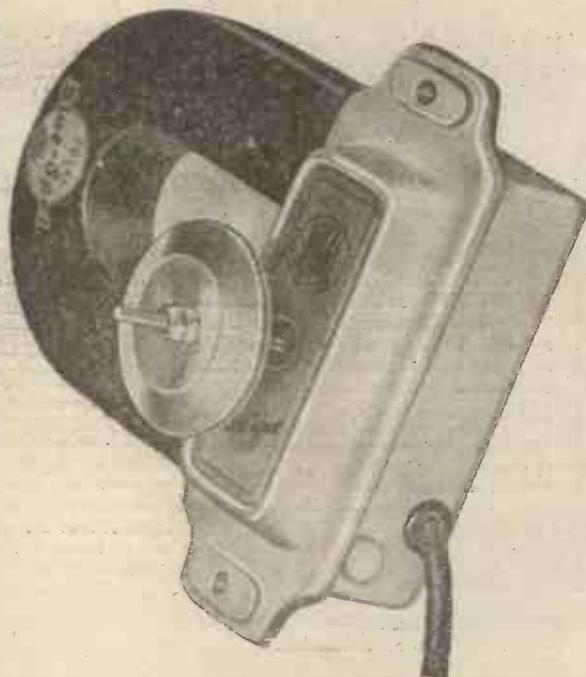
This eagerly awaited product incorporates several unique advantages. High-voltage and low-voltage plugs are not interchangeable—a safety device which prevents any possibility of valves being burnt out. The whole product is beautifully finished and insulated throughout. Made by the makers of the famous Belling-Lee terminals. Price 9d. (Panel portion 3d. each: flex. portion 6d. each.)

Ask for the new Belling-Lee insulated Wander Plug—the first Wander Plug on the market to be engraved. Choice of 14 engravings.

**BELLING-LEE**

Advt. of BELLING & LEE, Ltd., Queensway Works, Ponders End, Middlesex.

# Have you heard the BLUE SPOT 66A



## brother to the famous 66K?

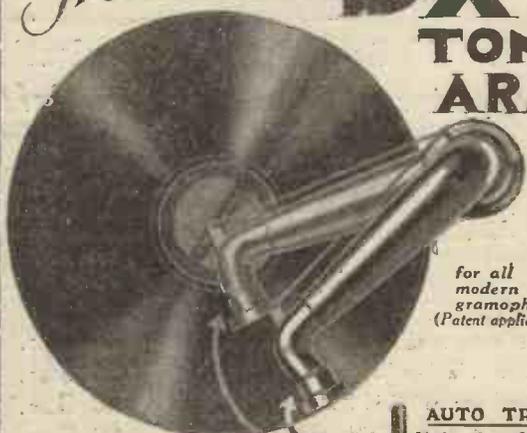
The Blue Spot 66A is exactly the same as the wonderful Blue Spot 66K Unit but without the adjusting device. In particular the 66A is the Ideal unit for the portable set because it has been adjusted by experts to the very closest possible limits, and requires no further attention whatever to reproduce the finest quality of music or the purest form of speech.

It will give splendid results on any normal H.T. voltage, and is one of the most sensitive units available. Price 21/6.

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# The NEW DX TONE ARM



for all modern gramophones (Patent applied for).

The new D.X. Tone Arm, which is also particularly suitable as a pick-up carrier, is especially designed to ensure that the needle is always in the most accurate alignment with the grooves in the record through the whole of its travel.

### THE AUTO TRACK FEATURE.

The sound-box end of the tone-arm is pivoted and its angle is controlled by a lever attached to the radial spring seen at the side of the tone arm. This ensures perfect reproduction and minimum wear on the record, thus prolonging the life of the record indefinitely.

### AUTO TRACK.

Note the feature—how the needle is kept always on correct alignment whether at the beginning or end of the record.

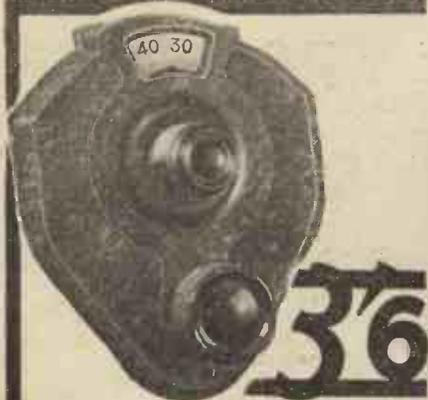
NOTE that the radial spring referred to can be adjusted so as to allow the sound-box to bear with just the right weight on the record—a very important feature, particularly when you wish to try different sound-boxes or electrical pick-ups.

The D.X. Auto Track Tone Arm

10/6 Post free.

D.X. COILS. LTD., 542, KINGSLAND RD., LONDON, E.8  
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# DOMINION VERNIER DIALS



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The mechanism is a special non-backlash design with a reduction ratio which makes fine tuning easy without becoming tedious.

Finished in plain black or beautifully grained mahogany Bakelite.



Nelson Street Works, London, N.W.1.



# RADIOTORIAL

All Editorial communications to be addressed to the Editor, **POPULAR WIRELESS**, Tallis House, Tallis Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

## QUESTIONS AND ANSWERS.

### FINDING THE POLARITY OF A LOUD SPEAKER.

M. J. W. (Norwich).—"The loud speaker had two cords, one red and one black. But without my permission these were taken off, and now I don't know which way to connect the thing up again. I remember reading a description of how to do this very easily in 'P.W.', and should be glad if you could give me this, as I do not want to ruin the speaker by connecting up wrongly."

The easiest method of determining which way round the speaker should be connected is the following:

Connect up the receiver, switch on the loud speaker, and carefully adjust the speaker's screw or lever until you hear the rattling which indicates that the diaphragm is now touching the magnet. Now very carefully and delicately alter the adjustment so that the diaphragm just clears the magnet and does not quite touch even with quite a strong signal.

Then, without altering anything else, reverse the loud-speaker leads, and one of two things will happen. Either the reproduction will sound just as good (or possibly weaker to a slight degree) or else you will once again hear the rattling noise, showing that the diaphragm and the magnets are touching. If you do hear this noise, then the connection you have at that time is the correct one, for it shows that in the way you have just joined up the leads the steady current is tending to help the magnetism and therefore is exerting a greater attraction than before.

(Continued on page 168.)

# WEARITE COMPONENTS

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"Titan 3," "Titan 2," "Titan Tuner," "Radiano"

	s.	d.
"TITAN" COIL UNIT (Immediate delivery from stock)	15	0
H.F. CHOKE	6	6
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10 x 7 COPPER SCREEN	4	6
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McMichael Screened Grid Super Four. The best yet offered to the public	35 Gns.
Selector V, in Blue Leather Case, complete	30 Gns.
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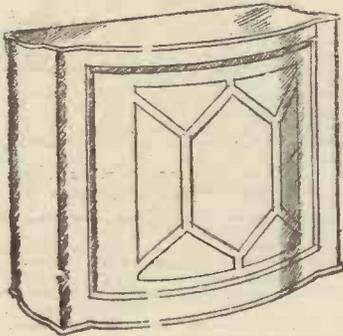
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3. It gives "Straight line" reproduction over the whole musical scale.
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5. With any good wireless set it gives greater volume and infinitely purer reproduction AND
6. It is guaranteed for 5 years against defective material or workmanship.

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WITH THIS COMPLETE ASSEMBLY YOU CAN CONSTRUCT IN A FEW MINUTES, a Loud-Speaker surpassing all your expectations! ANY GOOD UNIT YOU MAY HAVE—GOODMANS, "BLUE SPOT," "TRIOTRON," or "BULLEN," can be used. TWO MINUTES only—and the Unit is fixed in place, by the unique Cleat and Wing-nuts. The complete Assembly is then ready for fixing inside your Cabinet, or to a Baffle Board, with three screws. Lugs are provided on the outer Ring. SIMPLICITY OF CONSTRUCTION AND ASTOUNDING RESULTS are assured.



Overall Diameter  
10½ in.

Price  
**16/6** Complete  
(Ready for  
Mounting Unit.)

This assembly is definitely ahead of all others. It is fitted with a fully licensed GOODMANS Seamless Cone, made and treated by entirely new and absolutely exclusive doping processes, rendering it remarkably sensitive, and capable of reproduction of a fidelity and brilliance usually associated with the Moving-coil type Speaker.

Alternatively, supplied with Cone Kit (cut out Kraft Cone, suspension Leather, Cone Bush and Mounting Ring). 14/9 inclusive.  
As exclusively used in P.W. Purity Conc. Dec. 22nd, 1928, issue.

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WIRING DIAGRAMS—

FREE OF CHARGE

Reg. Dis. 711,404

**SOME OPINIONS.**

R. D. Paul, 265, Newbury Crescent, S.W.16, Jan., 1929. "Kit purchased from you on Friday. I wired up in 30 minutes. Results perfect. Dead silent background. I congratulate you."

J. P. Haversham, 12, Caunce Street, Blackpool, Aug. 1928. "Received previous set of components safely, and made up the unit, it works a treat, and not the least trace of hum."

**H.T., A.C. UNIT:**

200 volts at 30 m/a

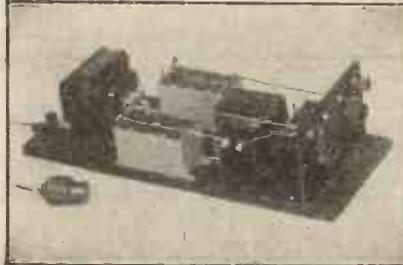
6 Variable Voltages,  
£2 16 3

12 Variable Voltages,  
£3 5 6

**D.C. UNIT,**

120 volts at 30 m/a

£1 1 9



"RADCROIX" All-Power Unit.

**ALL POWER UNIT.**

For 2 Valve Set.  
£3 0 0

For 3 Valve Set.  
£3 9 3

For 6 Valve Set  
£3 18 6

12 Variable Voltages,  
£3 18 6

**SOME OPINIONS.**

F. W. Taylor, 33, Burnthwaite Road, Liverpool. Feb., 1929. "I might add I have already built the 'Radcroix' All Power Unit, and consider it a fine unit."

T. Morton, 12, Ford Street, Durham, Aug., 1929. "The goods are of high order; I am delighted with them."

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Famous the world over  
for utmost efficiency and  
hardest wear and tear.

## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 166.)

which is what you want it to do. So all you need do now is to readjust your diaphragm a little so that it is cleared once more, and you will be sure that your connection is right for this particular loud speaker.

If, however, as previously mentioned, the reproduction sounds practically the same, then it is possible that your first adjustment is the correct one; but to check this you must readjust the loud-speaker diaphragm until it just touches once more, and then set it back until it is just clear again. Now reverse to the original connections and you should get the rattling noise referred to, confirming that these connections are the correct ones.

### CONSTRUCTING AN INDOOR AERIAL.

"MAC" (Dundee).—"As it is quite out of the question for me to use an outdoor aerial in the garden, I wish to know the best method of putting up one inside the house. I like the look of the diamond-shaped little aerials best,

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A postcard will do: On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

but I am told that they are only suitable for use with valve sets. Is that so, and if so, what is the best type for a crystal set?"

When using a crystal set it is essential to get as much energy as possible into it from the aerial, and as the pick-up of a frame aerial is extremely small a good indoor aerial will give far better results.

To construct this you must first of all find a suitable site inside the house. Generally, the best place to have such an aerial is near the rafters if you are placing the set somewhere not too far from the top of the house, and if you can get through a trap-door. Piling this, a long hallway or passage will be O.K., and as a last resource the wire can be stretched across the room. The objection to this in most cases is that by utilising the room considerably less space is generally available.

If you can get into the space underneath the roof run three long wires across this space at a distance of, say, two or three feet from each other. At the far end each of these three wires can be affixed to separate insulators suspended from a wall or rafter.

At the near end the three wires are joined together and taken down to the set in as direct a line as possible. It is important to keep the aerial wires themselves, and the down lead, as far away from the walls, beams, etc., as possible. Where they have to pass, for instance, through a wall, they can pass straight through it. Do not run an aerial close to a wall or ceiling for a greater distance than is absolutely necessary.

If a passage or hall is not available to fix up the aerial and it must be placed in a small room, it is sometimes advisable to try the effect of different shapes. Sometimes the pick-up from a broadcasting station may be greater if the aerial is round and round a picture-rail; whilst at other places we find zigzag fashion, from one side of the ceiling to the other, gives better results. Much depends upon the situation of the house and that of surrounding buildings, etc., so that the only way of determining the most satisfactory method of arranging an indoor aerial is to experiment with different forms until the best solution is found.

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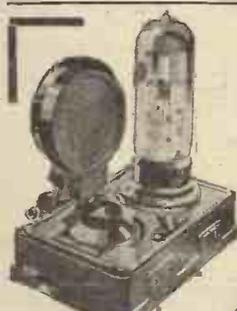
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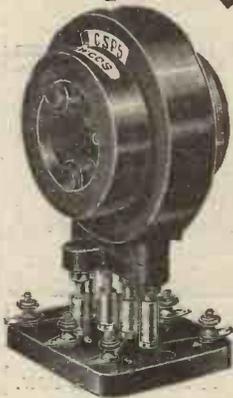
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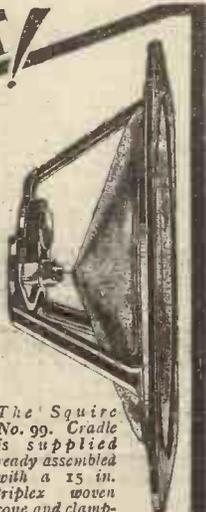
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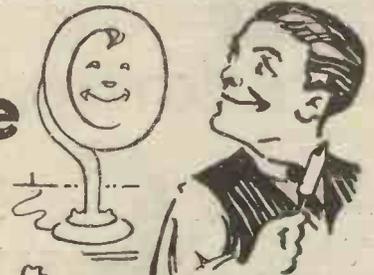
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## MAKING PORTABLE SETS.

(Continued from page 150.)

15 miles from your local station, unless conditions are more than usually unfavourable.

When choosing a circuit for this type of set, you need one which will give a very smooth control of reaction—upon which so much of the success of the set depends. Also avoid unnecessary refinements and gadgets which only complicate construction and operation without adding to the usefulness of the set.

A straightforward circuit, such as that of Fig. 4, which for sensitivity and ease of operation is hard to beat, is one that I can thoroughly recommend. The control knobs of the two condensers and an on-off L.T. switch can easily be arranged to protrude slightly through holes in one side of the case, so that the set can be worked without opening the lid.

A Tetrode Two-Valver. Another circuit which may be of more interest to those of you who like something a little out of the ordinary is that of Fig. 5.

Here we have two tetrodes, resistance-coupled, the first an A.P.412 R.C., and the second an A.P.412 H.F. This combination gives very nearly as much amplification as the circuit of Fig. 4, reaction control being particularly smooth, and works very well on only 40 volts H.T. You should have no difficulty in making up a set of this description to weigh not more than 9 lb. all in.

A 5-in. fibre case is a most convenient size to use for a two-valver, although it is possible to use a slightly smaller one, but the frame will not then be quite so efficient. With the 15-in. case the frame is best made by winding 35 closely wound turns of No. 26 wire, tapped at the twenty-eighth turn for the filament connection, around the wooden framework which slips inside the case.

A sketch of this framework is shown in Fig. 6, giving suggested positions for the various components. There is no need to use an expensive H.F. choke, a very satisfactory substitute is an empty cotton-reel wound full of No. 30 D.C.C. wire. This makes a very compact choke which is practically as efficient for its purpose as one you can buy.

### Light-Weight Transformers.

Regarding the inter-valve transformer, you will no doubt use one of those small, light-weight components of modern design which are as efficient as many heavier early models. For the circuit of Fig. 5, and, in fact, for any transformer-coupled two-valver, I would suggest a 6 to 1 component to be used with a detector valve having an impedance between 16,000 and 20,000 ohms. This will give you very good amplification and quality on 'phones. Any general-purpose valve will do for the second stage.

(Continued on page 172.)

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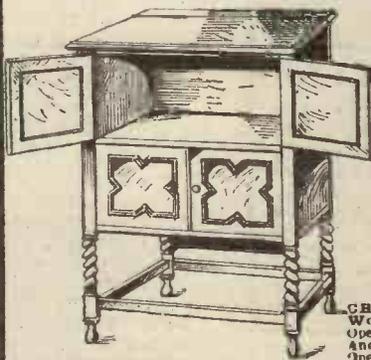


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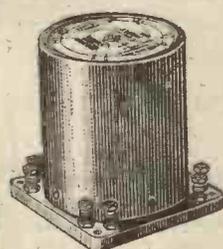
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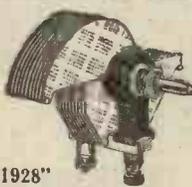
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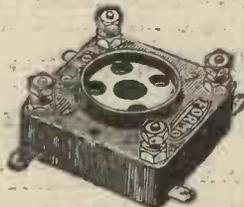
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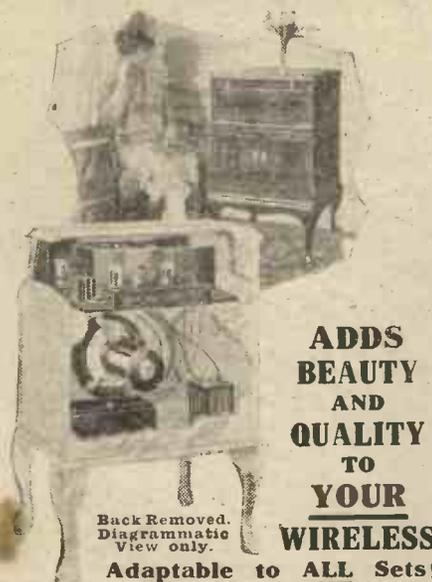
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# MAKING PORTABLE SETS.

(Continued from page 170.)

I have already dealt with H.T. and filament batteries above, so that no more need be said on that subject here. Lastly, provision may be made for using a temporary aerial by providing one or two tappings on the grid coil portion of the frame, an earth terminal being connected to filament negative.

### Short-Wave Portables.

I wonder how many of you have ever built a short-wave portable receiver? There is absolutely no reason why you should not do so, quite a number of such sets are used by amateur transmitters. Even if it is a short-wave set there is no need to be afraid of building it into a suitcase.

It will work quite well. In fact, a short-wave receiver very often works much better out of doors on quite a small aerial, than on your usual aerial. Remarkable results are sometimes obtained during daylight, when there are now nearly as many interesting short-wave signals to be heard as after dark.

In building such a set, preferably of the two-valve class, extra care must, of course, be given to the layout, and we cannot cramp up components so much as in an ordinary portable. The layout of the coils and tuning condensers and the detector circuit is of the most importance, the rest makes little difference.

### Very Versatile Receivers.

You can use any of the well-known short-wave circuit arrangements, those with "throttle"-controlled reaction being most suitable. With the short-wave portable it is better to arrange the controls to be operated with the lid open, bearing in mind that resting the case on the ground may upset the operation of the set when out in the open.

The enterprising amateur will not be at a loss for ways and means of adapting the set for medium-wave reception, and, given a little extra care with the coil arrangements, this makes a very versatile little set.

A slightly bent panel can be flattened by gently warming it and placing it between flat boards on which a heavy weight is standing until the ebonite has thoroughly cooled.

Do not attempt to start drilling until the exact point has been centre-punched on an ebonite panel, or otherwise the drill will tend to wander.

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PRICE 1/3 each.

**A. F. BULGIN & CO., 9-10-11, Cursitor St., Chancery Lane, London, E.C.4.**

# THE "TOM-TIT" THREE.

(Continued from page 162.)

The set may be wired with any type of stiff wire, either covered or bare. In the original, 16-gauge bare tinned copper wire was employed. Where convenient, wires are taken as straight from point to point as possible.

### The Wiring Diagram.

Right-angle bends are employed where their use does not definitely lengthen the leads, which, generally speaking, are quite short. The wiring is best examined in the photographs, as since the wiring diagram is drawn as though the panel and baseboard were in one plane, many of the leads look longer than they really are. One L.F. lead actually runs under the L.F. transformer, but it may not be possible to do this with all makes of L.F. transformer.

It is immaterial which two coils are used for short waves, and which for long, so long as the right reaction coil is coupled to the correct aerial coil.

The outside coil, that is to say the one nearest the edge of the baseboard, is the reaction coil in both cases. For the long-wave tuned coil use a No. 200, and for the lower-wave tuned coil a No. 60.

The reaction coils must be found by trial. In the case of the long waves a No. 60, 75, or 100 will be required, and for the lower waves a No. 25, 30 or 50.

### Concerning the Valves.

The first two valves can be of the H.F. type, although the second may be an L.F. valve if one is already on hand.

In the third position a power valve must be employed. If small volume only is required, a small power valve can be utilised in which case a 9-volt grid-bias battery should be sufficient. If, however, you desire really full loud-speaking, a super-power valve is necessary to avoid distortion, and two 9-volt batteries should be utilised.

The set can be worked with 2-, 4- or 6-volt valves; whatever are used; at least 120 volts H.T. should be available. If a super-power valve is employed, batteries of the triple-capacity type are needed.

### Operating the Set.

Now we may turn our attention to the operation of the set. Having connected up all the batteries, etc., and plugged in the two tuned coils, we may proceed to find the correct size reaction coils as follows.

Set the reaction condenser at zero and give the detector valve about 90 volts H.T. Now put the switch over to short waves and plug in one of the coils already mentioned for reaction on the lower waves. Next adjust the H.T. until the set can be made to just oscillate on any position of the tuning dial. These adjustments should be made with the aerial on the No. 1 terminal. If the set is not sufficiently selective, try the aerial on A2, and, if necessary, use a smaller reaction coil. A further adjustment of H.T. may be necessary.

Now switch over to the long-wave position, and plug in one of the long-wave reaction coils previously mentioned. If the set oscillates violently use a smaller coil, but if it will not oscillate sufficiently increase the H.T. on +1.

This should not be increased more than

(Continued on next page.)

NOTE CYLDON'S		REDUCED PRICES	
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Triple '0005	52/6	00015	5/6
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Condensers, '0005	10/-	0003	8/-

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**4 Pole Balanced Armature 17/6** With Cabinet as shown above and **12" Cone 27/6** Post Free

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P.W. 6/4/29. →

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P.W. 2/2 29

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'0005 Variable with S.M. Dial (LOTUS, ORMOND or POLAR), Micro '00005, LISSEN L.F. 8/6 (any other L.F. add balance), Wave-change Switch, L.T. do. "TITAN" COIL UNIT, 3 Spring V.H., R.I. VARLEY or LEWCOS H.F. Choke, one '0002 and two of '0003 fixed, 2 meg. Leak and Holder, 2 DUBILIER Mansbridge, THE LOT (or LISSEN), Standard Screen, THE LOT 2 H.T. Fuses, Terminal Strip, 11 Terminals (engraved), Wire, Screws, Flex, Plugs, and 14 x 7 Grade A Ebonite Panel. Post Free, U.K. G.O.D. 2/6 extra.

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Usual types 4/-  
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**THE "TOM-TIT" THREE.**

(Continued from previous page.)

10 volts, however, and if the set still will not oscillate use a larger coil and reduce the H.T. to its original voltage. The set is even less critical as far as the reaction coil is concerned on the long waves than it is on the short, so that no difficulty should be experienced in finding a suitable coil.

The maximum H.T. must be used on the H.T.+2 tap, and the set operated as far as the tuning and reaction condensers are concerned in a similar manner to any set with two such controls.

**Output Filter Advantageous.**

Since one of the objects in view when designing this receiver was simplicity, no device to avoid L.F. oscillation was incorporated and no output filter. With reference to the first, this was found to be entirely unnecessary in the original set.

If, however, you experience motor-boating or very bad distortion, or even a whistle or buzz, you should try the following. Between H.T.+1 and the H.T. battery connect an 80,000 or 100,000-ohm resistance, and connect 4 mfd. in fixed condensers across this + tap and H.T.—. You will probably find that this resistance makes it necessary to increase the H.T. to this tap by about 50 volts.

**MODERN WIRELESS**

is

**The Leading Radio Magazine**

An output filter is desirable for the best quality with any power valve, and although this set will work well without one, you should use such a device if at all possible. Some readers may have a filter connected up as a separate unit already.

If you have not, a good L.F. choke is needed, namely, one with a fairly low D.C. resistance and which will not saturate with a current below about 30 milliamperes at the least. Its inductance should be about 20 or 32 henries.

**FOR YOUR NOTEBOOK.**

When looking for a fault in the set disconnect the battery AT THE BATTERY END, not at the set end, before any tests are made.

Cone or moving-coil loud speakers of the free edge type which use a soft material to suspend the cone, are rather susceptible to the influence of the weather, so that a sudden change in the weather may necessitate a readjustment.

To test a pair of telephones disconnect them from the set and place them over the ears. Hold one of the little metal tags between the lips and gently rub a key along the other 'phone tag. If the 'phones are in good order you will hear a faint but distinct clicking sound in them corresponding with the rubbing.

**"BESTWAY" WIRELESS BOOKS**

Two new issues of this famous series are now on sale, containing full constructional details.

**INVALUABLE TO CONSTRUCTORS**

**"Bestway" Book No. 328**

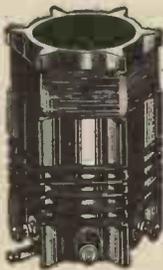
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HERE is something to appeal to the real enthusiast. As a rule, wave-meters are considered to be rather outside the scope of "P.W.," because they only appeal to a limited number of readers, and therefore it would not be justifiable to give the necessary amount of space to giving a design in detail.

However, in this series we have the opportunity to present a complete design in a very small space indeed, and so we can include a simple form of wave-meter which will enable you to put your identification and logging of stations on a very much more accurate and certain basis.

Probably not many of our readers realise what a delightful thing to use a good wave-meter can be, and so perhaps we had better start by giving an idea of what can be done with the aid of even a simple one.

**Spotting Stations.**

Well, first of all, it enables you to say good-bye quite definitely and finally to that lost feeling which is so apt to afflict even a fairly experienced operator when he starts to test a new set. With the aid of the wave-meter you just fix a few wave-lengths on the new dials, and soon find out where you are.

Again, once you get your wave-meter calibrated it means that you can cut out all that wearisome business of identifying stations by waiting for them to announce their names. Instead, you just measure the wave-length, listen to find out (if possible, this is merely a check) what language the announcer speaks, and then turn up "World Radio" and see which station fits the facts. Spotting stations becomes quite a quick business this way, and consequently you can generally identify far more of them in the course of an evening with a given set.

**How It Works.**

A wave-meter has a number of other applications almost as useful as these, but what we have said should be enough to prove that it is an appliance well worth consideration, even if it does involve a certain outlay to get it going. As a matter of fact, this expense question need not be a very grave objection, because such a meter as the one we are going to describe can be made very largely out of odd parts, and the batteries are not expensive ones.

The one we have chosen for the "White Print" series is a very simple form of heterodyne wave-meter, that is to say, it is of the oscillating valve type. In this form of meter we have a simple single-valve reaction circuit which is adjusted to the oscillating condition, and therefore radiates weak waves at the particular wave-length to which it happens to be tuned. This radiation will only be quite weak, of course, since the oscillator is not connected to aerial and earth.

In use the meter is placed somewhere near to the receiving set, and if a distant station is tuned in and the meter dial is next turned you

**THE "P.W." "WHITE PRINTS."**  
A UNIQUE SERVICE FOR OUR READERS.

**White Print No. 19 :: :: A Heterodyne Wavemeter.**

This week we publish the nineteenth of our White Prints. This page may be easily and safely torn out—along the dotted-line overleaf—and the "White Print" filed. In due course you will thus have available an encyclopaedic collection of the best circuits used in modern radio practice. A "White Print" will be published on the last page every week in "P.W." until further notice.—THE EDITOR.

will presently hear a chirp just like the howl of a distant receiving set being made to oscillate. If you turn the oscillator (i.e. wave-meter) dial so that the chirp comes down to the silent point in the middle, you will have found the wave-meter reading for that particular station, and will always be able to spot it again whenever you happen to tune it in, even on a new set whose dial readings you do not know.

Now for some very condensed details of the actual design illustrated. The circuit is a Hartley oscillator, and you require two centre-tapped coils, a No. 60 for the lower wave-band (about 250 to 500 metres) and a No. 250 for the long waves (about 900 or 1,000 or 2,000 metres).

The semi-variable condenser  $C_2$  is of the screw-down compression type, and adjusts the amount of reaction. This should be set so as to make the circuit oscillate freely over the tuning range, and if possible so that it does not quite break into a squeal at the bottom of the dial. (Test by listening on

closed in the cabinet (remember to have this battery charged at intervals, it has a rather idle and unhealthy life otherwise).

The valve can be almost any 2-volter except a super power, H.F. and general purpose or L.F. types being preferable as a rule. Remember that when the valve dies you lose your calibration, so be careful with it.

It is not a bad scheme to calibrate the meter with two different valves, and keep one of them by as a spare.

**Calibrating the Meter.**

Calibration is rather a large subject, but we will just give a brief outline of the general method of carrying out this work, in the absence of a properly calibrated master wave-meter.

Those of you who undertake the construction of an instrument such as this will have had sufficient experience to be able to identify with certainty, say, half a dozen stations on the medium broadcast wave-band.

Well, then, let us suppose that 2 L O is one station, 5 G B another, and that between these two wave-lengths you are able to tune in four known transmissions.

Obtain a piece of squared graph paper and mark off wave-lengths in metres along the vertical axis and wave-meter dial readings along the horizontal axis. You will thus be able to plot a graph of dial readings against wave-lengths, within the limits you choose. Naturally, you will commence your wave-lengths at about 250 metres and finish at 500. Your dial readings will be 0-100 or 0-180, depending upon the type of dial you have. Now tune in, say, 2 L O on your set, and during an interval in the programme adjust the wave-meter to the silent point, as described previously. This will give you one setting upon your wave-meter dial and can be used for a calibration point on the graph.

Look up the wave-length of the station in the "Radio Times" or "World Radio" and make a cross or dot on the squared paper opposite the wave-length on the vertical axis and the dial reading along the horizontal axis. Carry out the same procedure with 5 G B and four or five other transmissions.

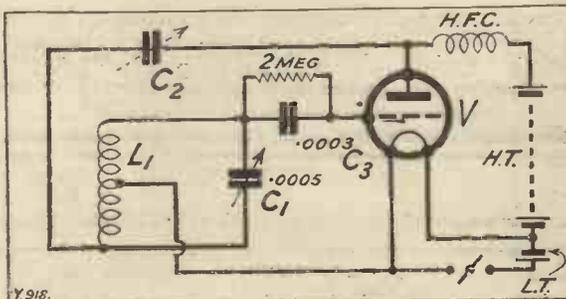
The greater the number of calibration points you can obtain the more accurate will be your chart. Choose one point near your maximum and another point near your minimum wave-lengths.

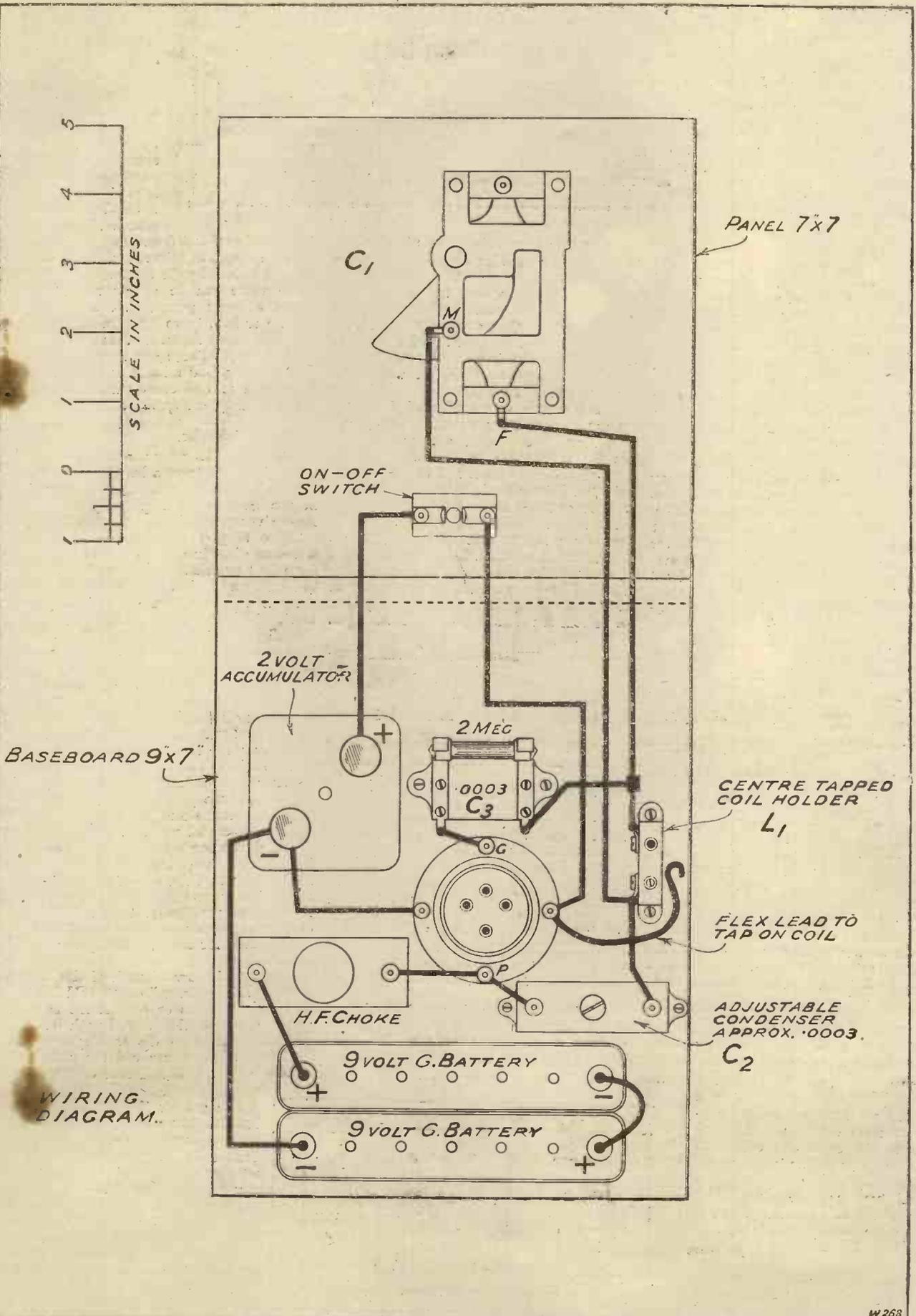
Then, having plotted the points on the graph paper, draw through them a line or curve. You will now have a chart from which it will be possible for you to obtain the identity of any unknown station which comes within the limits of your meter.

**COMPONENTS**

- 1 Panel, 7 in. x 7 in. x 1/4 in.
- 1 Cabinet to fit, with baseboard 9 or 10 in. deep.
- 1 .0005 mfd. variable condenser, with slow-motion or really good vernier dial.
- NOTE.—A really sound and high-quality condenser is essential.
- 1 .0003 mfd. (approx.) semi-variable condenser (compression type, capable of being set and locked).
- 1 .0003 mfd. grid condenser and 2 meg. leak.
- 1 Valve holder.
- 1 H.F. choke.
- 1 L.T. switch.
- 1 coil holder (single).
- Flex, wire, screws, etc.

a set with the meter close to it, make the set oscillate, and see if you hear chirps from the meter at various points around the dials. You should be able to place the set tuning anywhere, make the receiver oscil-





WHERE'S  
MY  
HAT!



**You, too, will make a dash for the nearest shop that sells Mullard Pentone and Screened Grid valves directly you hear them.**

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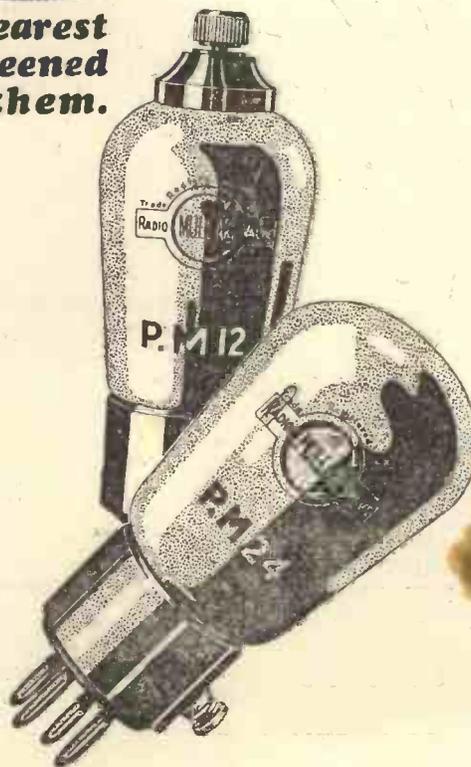
The best brains, the best machinery, the best methods have gone to the perfection of Mullard Pentone and Screened Grid Valves. Months have been spent in testing and counter-testing them in the most Modern radio research laboratories in the world. Now, with the utmost confidence, we place them at the disposal of the public, stamped with the name MULLARD - the name that is a gilt-edged guarantee of radio perfection.

In short, Mullard P.M. Pentone and Screened Grid Valves are the radio valves of the future that you can buy NOW!

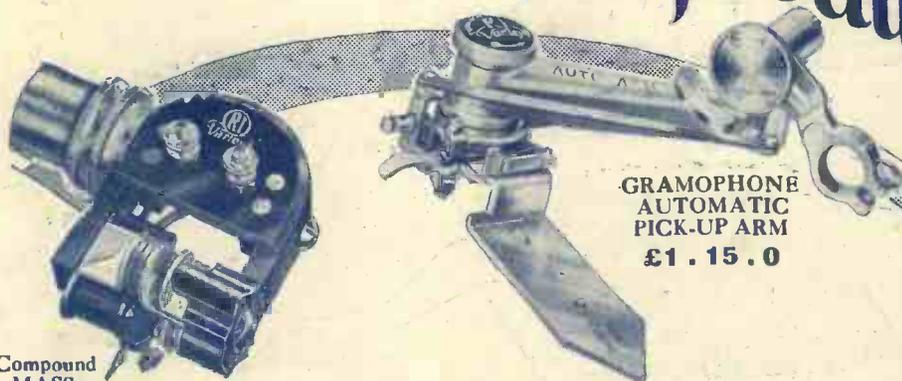
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Our Compound Mass Suspension Pick-up and Automatic Pick-up Arm add the final touch of perfection to Gramophone Electrical Reproduction.

Sections A, C & D of our Catalogue (free on application) give full particulars of these products.



**BI-DUPLEX WIRE-WOUND RESISTANCE CAPACITY COUPLER.**  
Type A, £1. Type C, 17/6  
Type D, 16/-

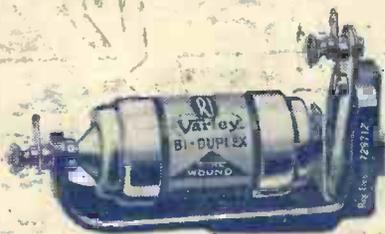


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